Filed April 12, 2022

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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

APPLE INC.

Petitioner,

v.

MASIMO CORPORATION,

Patent Owner.

IPR2020-01715
U.S. Patent 10,631,765

PATENT OWNER'S NOTICE OF APPEAL TO THE U.S. COURT OF APPEALS FOR THE FEDERAL CIRCUIT

Pursuant to 28 U.S.C. § 1295(a)(4)(A), 35 U.S.C. §§ 141(c), 142, and 319, 37 C.F.R. §§ 90.2(a) and 90.3, and Rule 4(a) of the Federal Rules of Appellate Procedure, Patent Owner Masimo Corporation ("Masimo") hereby appeals to the United States Court of Appeals for the Federal Circuit from the Judgement – Final Written Decision (Paper 33) entered on April 6, 2022 (Attachment A) and from all underlying orders, decisions, rulings, and opinions that are adverse to Masimo related thereto and included therein, including those within the Decision Granting Institution of *Inter Partes* Review, entered April 13, 2021 (Paper 8). Masimo appeals the Patent Trial and Appeal Board's determination that claims 1-29 of U.S. Patent 10,631,765 are unpatentable, and all other findings and determinations, including but not limited to claim construction, as well as all other issues decided adverse to Masimo's position or as to which Masimo is dissatisfied in IPR2020-01715 involving U.S. Patent 10,631,765.

Masimo is concurrently providing true and correct copies of this Notice of Appeal, along with the required fees, with the Director of the United States Patent and Trademark Office and the Clerk of the United States Court of Appeals for the Federal Circuit.

Respectfully submitted,

KNOBBE, MARTENS, OLSON & BEAR, LLP

Dated: April 12, 2022

/Jarom Kesler/
Jarom D. Kesler (Reg. No. 57,046)

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ATTACHMENT A

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571-272-7822

Paper 33
Date: April 6, 2022

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

APPLE INC.,
Petitioner,

v.

MASIMO CORPORATION,
Patent Owner.

IPR2020-01715
Patent 10,631,765 B1

Before JOSIAH C. COCKS, ROBERT L. KINDER, and AMANDA F. WIEKER, *Administrative Patent Judges*.

WIEKER, *Administrative Patent Judge*.

JUDGMENT
Final Written Decision
Determining All Challenged Claims Unpatentable
35 U.S.C. § 318(a)

I. INTRODUCTION

A. Background

Apple Inc. ("Petitioner") filed a Petition requesting an *inter partes* review of claims 1–29 ("challenged claims") of U.S. Patent No. 10,631,765 B1 (Ex. 1001, "the '765 patent"). Paper 3 ("Pet."). Masimo Corporation ("Patent Owner") waived filing a preliminary response. Paper 7 ("PO Waiver"). We instituted an *inter partes* review of all challenged claims 1–29 on all grounds of unpatentability, pursuant to 35 U.S.C. § 314. Paper 8 ("Inst. Dec.").

After institution, Patent Owner filed a Response (Paper 17, "PO Resp.") to the Petition, Petitioner filed a Reply (Paper 21, "Pet. Reply"), and Patent Owner filed a Sur-reply (Paper 26, "PO Sur-reply"). An oral hearing was held on January 19, 2022, and a transcript of the hearing is included in the record. Paper 32 ("Tr.").

We issue this Final Written Decision pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73. For the reasons set forth below, Petitioner has met its burden of showing, by a preponderance of the evidence, that challenged claims 1–29 of the '765 patent are unpatentable.

B. Related Matters

The parties identify the following matters related to the '765 patent:

Masimo Corporation v. Apple Inc., Civil Action No. 8:20-cv-00048 (C.D. Cal.) (filed Jan. 9, 2020);

Apple Inc. v. Masimo Corporation, IPR2020-01714 (PTAB Sept. 30, 2020) (challenging claims 1–29 of the '765 patent);

Apple Inc. v. Masimo Corporation, IPR2020-01520 (PTAB Aug. 31, 2020) (challenging claims of U.S. Patent No. 10,258,265 B1);

Apple Inc. v. Masimo Corporation, IPR2020-01521 (PTAB Sept. 2, 2020) (challenging claims of U.S. Patent No. 10,292,628 B1);

Apple Inc. v. Masimo Corporation, IPR2020-01523 (PTAB Sept. 9, 2020) (challenging claims of U.S. Patent No. 8,457,703 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01524 (PTAB Aug. 31, 2020) (challenging claims of U.S. Patent No. 10,433,776 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01526 (PTAB Aug. 31, 2020) (challenging claims of U.S. Patent No. 6,771,994 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01536 (PTAB Aug. 31, 2020) (challenging claims of U.S. Patent No. 10,588,553 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01537 (PTAB Aug. 31, 2020) (challenging claims of U.S. Patent No. 10,588,553 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01538 (PTAB Sept. 2, 2020) (challenging claims of U.S. Patent No. 10,588,554 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01539 (PTAB Sept. 2, 2020) (challenging claims of U.S. Patent No. 10,588,554 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01713 (PTAB Sept. 30, 2020) (challenging claims of U.S. Patent No. 10,624,564 B1);

Apple Inc. v. Masimo Corporation, IPR2020-01716 (PTAB Sept. 2, 2020) (challenging claims of U.S. Patent No. 10,702,194 B1);

Apple Inc. v. Masimo Corporation, IPR2020-01722 (PTAB Oct. 2, 2020) (challenging claims of U.S. Patent No. 10,470,695 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01723 (PTAB Oct. 2, 2020) (challenging claims of U.S. Patent No. 10,470,695 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01733 (PTAB Sept. 30, 2020) (challenging claims of U.S. Patent No. 10,702,195 B1); and

Apple Inc. v. Masimo Corporation, IPR2020-01737 (PTAB Sept. 30, 2020) (challenging claims of U.S. Patent No. 10,709,366 B1).

Pet. 3–4; Paper 5, 1–4.

Patent Owner further identifies the following pending patent applications, among other issued and abandoned applications, that claim priority to, or share a priority claim with, the '765 patent:

U.S. Patent Application No. 16/834,538;

U.S. Patent Application No. 16/449,143; and

U.S. Patent Application No. 16/805,605.

Paper 5, 1–2.

C. The '765 Patent

The '765 patent is titled "Multi-Stream Data Collection System for Noninvasive Measurement of Blood Constituents," and issued on April 28, 2020, from U.S. Patent Application No. 16/725,478, filed December 23, 2019. Ex. 1001, codes (21), (22), (45), (54). The '765 patent claims priority through a series of continuation and continuation-in-part applications to Provisional Application Nos. 61/078,228 and 61/078,207, both filed July 3, 2008. *Id.* at codes (60), (63).

The '765 patent discloses a two-part data collection system including a noninvasive sensor that communicates with a patient monitor. *Id.* at 2:38–40. The sensor includes a sensor housing, an optical source, and several photodetectors, and is used to measure a blood constituent or analyte, e.g., oxygen or glucose. *Id.* at 2:29–35, 64–65. The patient monitor includes a

display and a network interface for communicating with a handheld computing device. *Id.* at 2:45–48.

Figure 1 of the '765 patent is reproduced below.

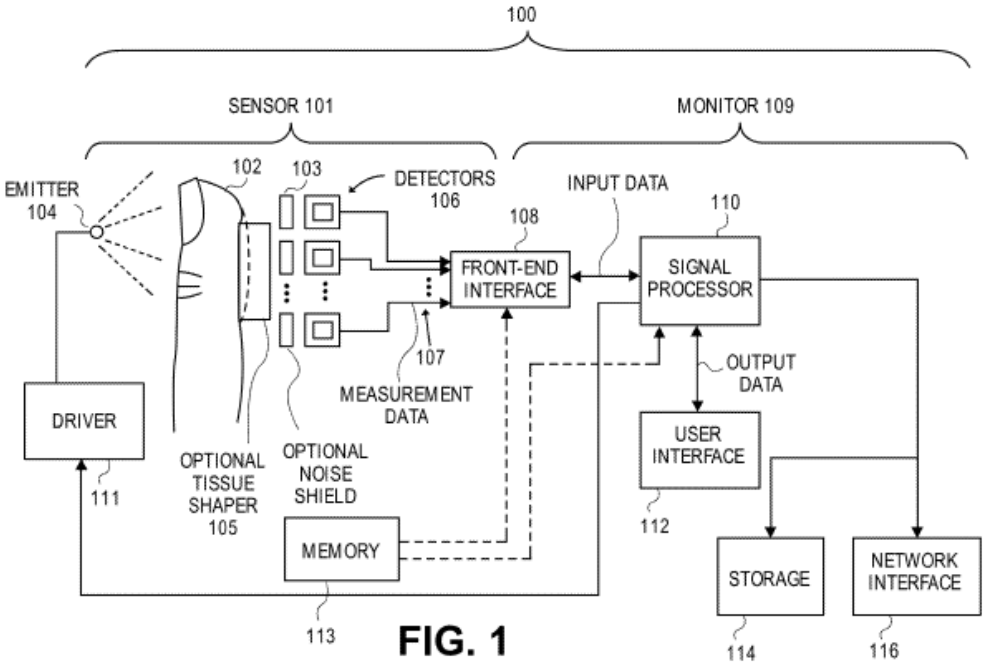


FIG. 1

Figure 1 illustrates a block diagram of data collection system 100 including sensor 101 and monitor 109. *Id.* at 11:47–58. Sensor 101 includes optical emitter 104 and detectors 106. *Id.* at 11:59–63. Emitters 104 emit light that is attenuated or reflected by the patient's tissue at measurement site 102. *Id.* at 14:3–7. Detectors 106 capture and measure the light attenuated or reflected from the tissue. *Id.* In response to the measured light, detectors 106 output detector signals 107 to monitor 109 through front-end interface 108. *Id.* at 14:7–10, 26–32. Sensor 101 also may include tissue shaper 105, which may be in the form of a convex surface that: (1) reduces the thickness of the patient's measurement site; and (2) provides more surface area from which light can be detected. *Id.* at 11:2–14.

Monitor 109 includes signal processor 110 and user interface 112. *Id.* at 15:16–18. "[S]ignal processor 110 includes processing logic that determines measurements for desired analytes . . . based on the signals received from the detectors." *Id.* at 15:21–24. User interface 112 presents the measurements to a user on a display, e.g., a touch-screen display. *Id.* at 15:46–56. The monitor may be connected to storage device 114 and network interface 116. *Id.* at 15:60–16:11.

The '765 patent describes various examples of sensor devices. Figures 14D and 14F, reproduced below, illustrate detector portions of sensor devices.

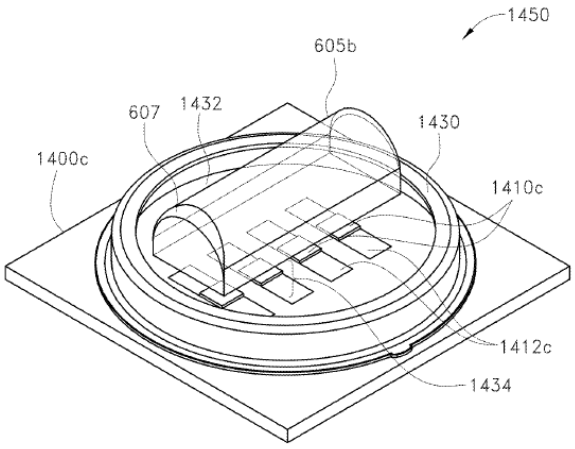


FIG. 14D

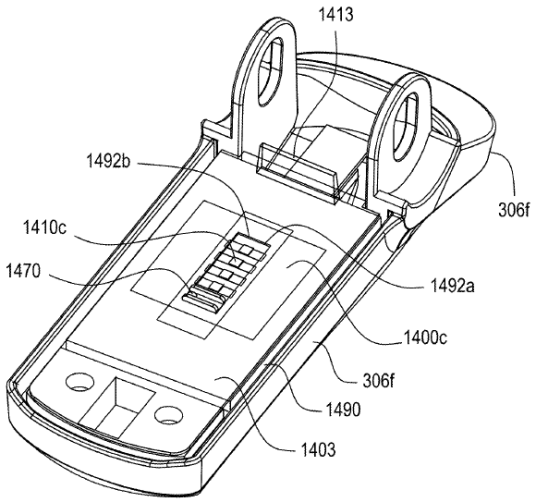


FIG. 14F

Figure 14D illustrates portions of a detector submount and Figure 14F illustrates portions of a detector shell. *Id.* at 6:44–47. As shown in Figure 14D, multiple detectors 1410c are located within housing 1430 and under transparent cover 1432, on which protrusion 605b (or partially cylindrical protrusion 605) is disposed. *Id.* at 35:36–39, 36:30–37. Figure 14F illustrates a detector shell 306f including detectors 1410c on substrate 1400c. *Id.* at 37:9–17. Substrate 1400c is enclosed by shielding

enclosure 1490 and noise shield 1403, which include window 1492a and window 1492a, respectively, placed above detectors 1410c. *Id.* Alternatively, cylindrical housing 1430 may be disposed under noise shield 1403 and may enclose detectors 1410c. *Id.* at 37:47–48.

Figures 4A and 4B, reproduced below, illustrate an alternative example of a tissue contact area of a sensor device.

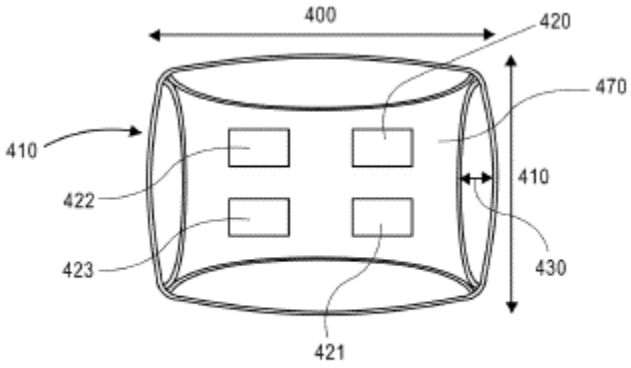


FIG. 4A

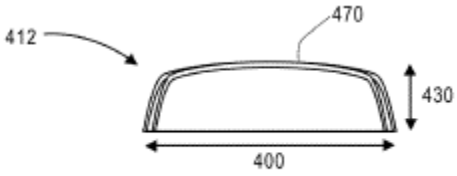


FIG. 4B

Figures 4A and 4B illustrate arrangements of protrusion 405 including measurement contact area 470. *Id.* at 23:18–24. "[M]easurement site contact area 470 can include a surface that molds body tissue of a measurement site." *Id.* "For example, . . . measurement site contact area 470 can be generally curved and/or convex with respect to the measurement site." *Id.* at 23:39–43. The measurement site contact area may include windows 420–423 that "mimic or approximately mimic a configuration of, or even house, a plurality of detectors." *Id.* at 23:49–63.

D. Illustrative Claim

Of the challenged claims, claims 1 and 21 are independent. Claim 1 is illustrative and is reproduced below.

1. A physiological measurement system comprising:

[a] a physiological sensor device comprising:

[b] one or more emitters configured to emit light into tissue of a user;

[c] at least four detectors, wherein each of the at least four detectors has a corresponding window that allows light to pass through to the detector;

[d] a wall that surrounds at least the at least four detectors; and

[e] a cover comprising a protruding convex surface, wherein the protruding convex surface is above all of the at least four detectors, wherein at least a portion of the protruding convex surface is rigid, and wherein the cover operably connects to the wall; and

[f] a handheld computing device in wireless communication with the physiological sensor device, wherein the handheld computing device comprises:

[g] one or more processors configured to wirelessly receive one or more signals from the physiological sensor device, the one or more signals responsive to at least a physiological parameter of the user;

[h] a touch-screen display configured to provide a user interface, wherein:

[i] the user interface is configured to display indicia responsive to measurements of the physiological parameter, and

[j] an orientation of the user interface is configurable responsive to a user input; and

[k] a storage device configured to at least temporarily store at least the measurements of the physiological parameter.

Ex. 1001, 44:51–45:15 (bracketed identifiers a–k added). Independent claim 21 includes limitations substantially similar to limitations [a]–[f] of claim 1. *Id.* at 46:31–49.

E. Applied References

Petitioner relies upon the following references:

> Bergey, U.S. Patent No. 3,789,601, filed July 15, 1971, issued February 5, 1974 (Ex. 1016, "Bergey");
>
> Ohsaki et al., U.S. Patent Application Publication No. 2001/0056243 A1, filed May 11, 2001, published December 27, 2001 (Ex. 1009, "Ohsaki");
>
> Aizawa, U.S. Patent Application Publication No. 2002/0188210 A1, filed May 23, 2002, published December 12, 2002 (Ex. 1006, "Aizawa");
>
> Inokawa et al., Japanese Patent Application Publication No. 2006-296564 A, filed April 18, 2005, published November 2, 2006 (Ex. 1007, "Inokawa");[1] and
>
> Y. Mendelson et al., "A Wearable Reflectance Pulse Oximeter for Remote Physiological Monitoring," Proceedings of the 28th IEEE EMBS Annual International Conference, 912–915 (2006) (Ex. 1010, "Mendelson-2006").

Pet. 10.

Petitioner also submits, *inter alia*, the Declaration of Thomas W. Kenny, Ph.D. (Ex. 1003), and the Second Declaration of Thomas W. Kenny (Ex. 1047). Patent Owner submits, *inter alia*, the Declaration of Vijay K. Madisetti, Ph.D. (Ex. 2004). The parties also provide deposition testimony from Dr. Kenny and Dr. Madisetti, including from this proceeding and others. *See* Exs. 1052–1054, 2006–2009, 2027.

[1] Petitioner relies on a certified English translation of Inokawa (Ex. 1008). In this Decision, we also refer to the translation.

F. Asserted Grounds of Unpatentability

We instituted an *inter partes* review based on the following grounds.

Claim(s) Challenged	35 U.S.C. §	References/Basis
1–8, 10–13, 15–29	103	Aizawa, Inokawa, Ohsaki, Mendelson-2006
9	103	Aizawa, Inokawa, Ohsaki, Mendelson-2006, Bergey
14	103	Aizawa, Inokawa, Ohsaki, Mendelson-2006, Goldsmith

II. DISCUSSION

A. Claim Construction

For petitions filed on or after November 13, 2018, a claim shall be construed using the same claim construction standard that would be used to construe the claim in a civil action under 35 U.S.C. § 282(b). 37 C.F.R. § 42.100(b) (2019). Petitioner submits that no claim term requires express construction. Pet. 9. Patent Owner submits that claim terms should be given their ordinary and customary meaning, consistent with the Specification. PO Resp. 9.

We agree that no claim terms require express construction. *Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co. Ltd.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017).

B. Principles of Law

A claim is unpatentable under 35 U.S.C. § 103(a) if "the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains." *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 406

(2007). The question of obviousness is resolved on the basis of underlying factual determinations, including (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of skill in the art; and (4) objective evidence of nonobviousness.[2] *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966). When evaluating a combination of teachings, we must also "determine whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue." *KSR*, 550 U.S. at 418 (citing *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006)). Whether a combination of elements would have produced a predictable result weighs in the ultimate determination of obviousness. *Id.* at 416–417.

In an *inter partes* review, the petitioner must show with particularity why each challenged claim is unpatentable. *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016); 37 C.F.R. § 42.104(b). The burden of persuasion never shifts to Patent Owner. *Dynamic Drinkware, LLC v. Nat'l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015). To prevail, Petitioner must support its challenge by a preponderance of the evidence. 35 U.S.C. § 316(e); 37 C.F.R. § 42.1(d).

We analyze the challenges presented in the Petition in accordance with the above-stated principles.

C. Level of Ordinary Skill in the Art

Petitioner identifies the appropriate level of skill in the art as that possessed by a person with "a Bachelor of Science degree in an academic discipline emphasizing the design of electrical, computer, or software

[2] Patent Owner has not presented objective evidence of non-obviousness.

technologies, in combination with training or at least one to two years of related work experience with capture and processing of data or information." Pet. 9 (citing Ex. 1003 ¶¶ 20–21). "Alternatively, the person could have also had a Master of Science degree in a relevant academic discipline with less than a year of related work experience in the same discipline." *Id.*

Patent Owner makes several observations regarding Petitioner's identified level of skill in the art but, "[f]or this proceeding, [Patent Owner] nonetheless applies Petitioner's asserted level of skill." PO Resp. 9–10 (citing Ex. 2004 ¶¶ 32–35).

We adopt Petitioner's assessment as set forth above, which appears consistent with the level of skill reflected in the Specification and prior art.

D. Obviousness over the Combined Teachings of Aizawa, Inokawa, Ohsaki, and Mendelson-2006

Petitioner contends that claims 1–8, 10–13, and 15–29 of the '765 patent would have been obvious over the combined teachings of Aizawa, Inokawa, Ohsaki, and Mendelson-2006. Pet. 11–93; *see generally* Pet. Reply. Patent Owner disagrees. PO Resp. 11–66; *see generally* PO Sur-reply.

Based on our review of the parties' arguments and the cited evidence of record, we determine that Petitioner has met its burden of showing by a preponderance of evidence that claims 1–8, 10–13, and 15–29 are unpatentable.

1. Overview of Aizawa (Ex. 1006)

Aizawa is a U.S. patent application publication titled "Pulse Wave Sensor and Pulse Rate Detector," and discloses a pulse wave sensor that

detects light output from a light emitting diode and reflected from a patient's artery. Ex. 1006, codes (54), (57).

Figure 1(a) of Aizawa is reproduced below.

FIG. 1 (a)

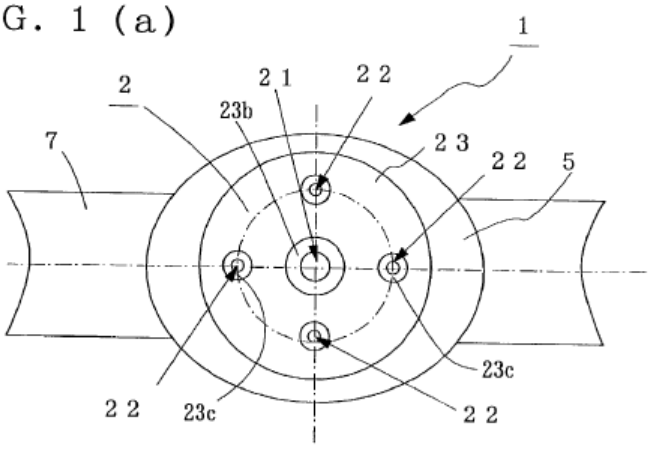


Figure 1(a) is a plan view of a pulse wave sensor. *Id.* ¶ 23. As shown in Figure 1(a), pulse wave sensor 2 includes light emitting diode ("LED") 21, four photodetectors 22 symmetrically disposed around LED 21, and holder 23 for storing LED 21 and photodetectors 22. *Id.* Aizawa discloses that, "to further improve detection efficiency, . . . the number of the photodetectors 22 may be increased." *Id.* ¶ 32, Fig. 4(a). "The same effect can be obtained when the number of photodetectors 22 is 1 and a plurality of light emitting diodes 21 are disposed around the photodetector 22." *Id.* ¶ 33.

Figure 1(b) of Aizawa is reproduced below.

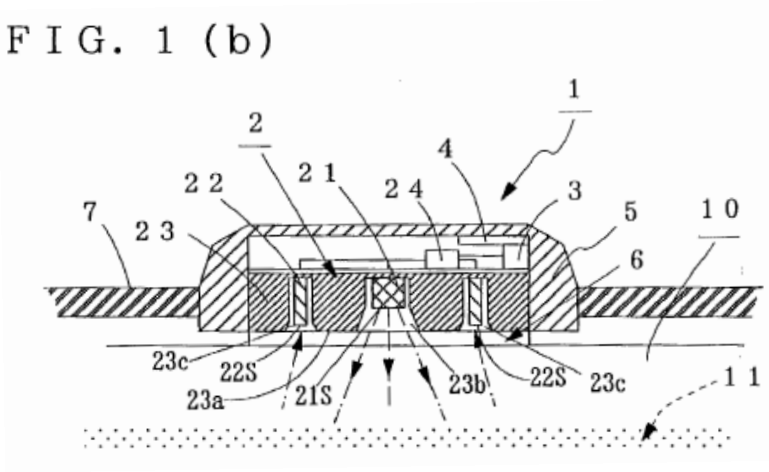


Figure 1(b) is a sectional view of the pulse wave sensor. *Id.* ¶ 23. As shown in Figure 1(b), pulse wave sensor 2 includes drive detection circuit 24 for detecting a pulse wave by amplifying the outputs of photodetectors 22. *Id.* ¶ 23. Arithmetic circuit 3 computes a pulse rate from the detected pulse wave and transmitter 4 transmits the pulse rate data to an "unshown display." *Id.* The pulse rate detector further includes outer casing 5 for storing pulse wave sensor 2, acrylic transparent plate 6 mounted to detection face 23a of holder 23, and attachment belt 7. *Id.* ¶ 23.

Aizawa discloses that LED 21 and photodetectors 22 "are stored in cavities 23b and 23c formed in the detection face 23a" of the pulse wave sensor. *Id.* ¶ 24. Detection face 23a "is a contact side between the holder 23 and a wrist 10, respectively, at positions where the light emitting face 21s of the light emitting diode 21 and the light receiving faces 22s of the photodetectors 22 are set back from the above detection face 23a." *Id.* ¶ 24. Aizawa discloses that "a subject carries the above pulse rate detector 1 on the inner side of his/her wrist 10 . . . in such a manner that the light emitting face 21s of the light emitting diode 21 faces down (on the wrist 10 side)."

Id. ¶ 26. Furthermore, "the above belt 7 is fastened such that the acrylic transparent plate 6 becomes close to the artery 11 of the wrist 10. Thereby, adhesion between the wrist 10 and the pulse rate detector 1 is improved." *Id.* ¶¶ 26, 34.

2. Overview of Inokawa (Ex. 1007)

Inokawa is a Japanese published patent application titled "Optical Vital Sensor, Base Device, Vital Sign Information Gathering System, and Sensor Communication Method," and discloses a pulse sensor device. Ex. 1008 ¶ 6.

Figure 1 of Inokawa is reproduced below.

(FIG. 1)

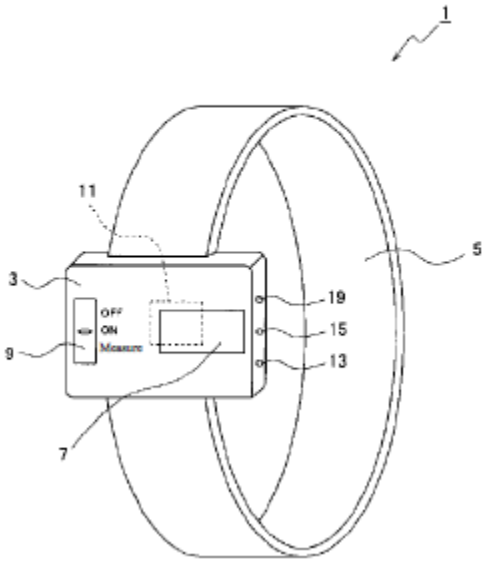


Figure 1 illustrates a schematic view of a pulse sensor. *Id.* ¶ 56. Pulse sensor 1 includes box-shaped sensor unit 3 and flexible annular wristband 5. *Id.* ¶ 57. Sensor unit 3 includes a top surface with display 7 and control switch 9, and a rear surface (sensor-side) with optical device component 11 for optically sensing a user's pulse. *Id.*

Figure 2 of Inokawa is reproduced below.

(FIG. 2)

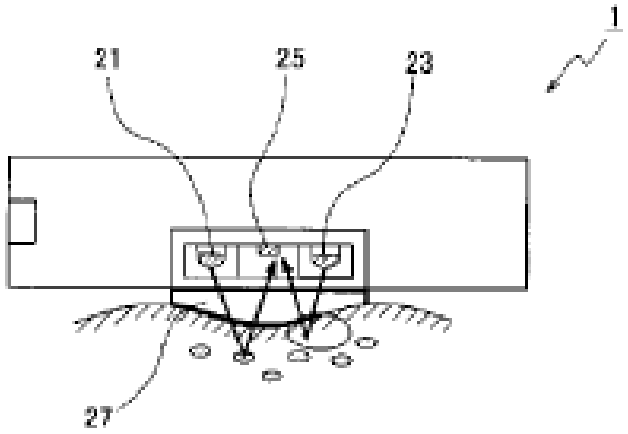


Figure 2 illustrates a schematic view of the rear surface of the pulse sensor. *Id.* ¶ 58. The rear-side (sensor-side) of pulse sensor 1 includes a pair of light-emitting elements, i.e., green LED 21 and infrared LED 23, as well as photodiode 25 and lens 27. *Id.* In various embodiments, Inokawa discloses that the sensor-side lens is convex. *See id.* ¶¶ 99, 107. Green LED 21 is used to sense "the pulse from the light reflected off of the body (i.e.[,] change in the amount of hemoglobin in the capillary artery)," and infrared LED 23 is used to sense body motion from the change in reflected light. *Id.* ¶ 59. The pulse sensor stores this information in memory. *Id.* ¶ 68. To read and store information, the pulse sensor includes a CPU that "performs the processing to sense pulse, body motion, etc. from the signal . . . and temporarily stores the analysis data in the memory." *Id.* ¶ 69.

Figure 3 of Inokawa is reproduced below.

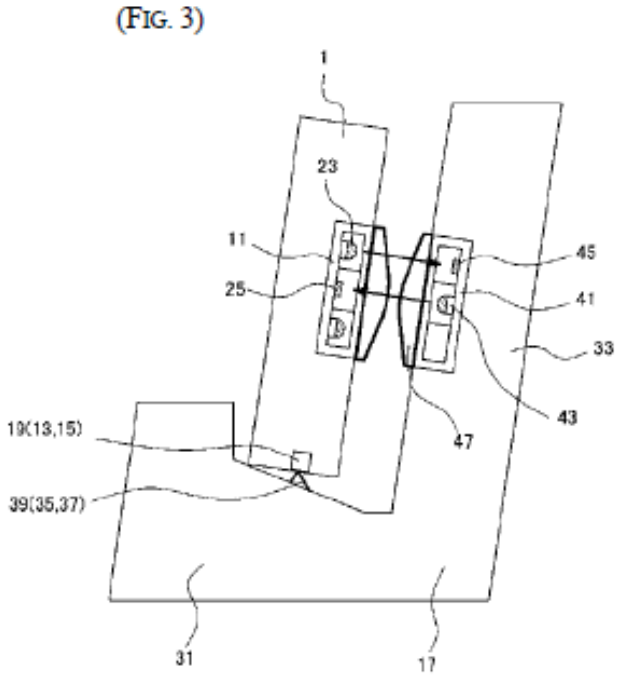


Figure 3 illustrates a schematic view of a pulse sensor mounted to a base device. *Id.* ¶ 60. Pulse sensor 1 is depicted as mounted to base device 17, which "is a charger with communication functionality." *Id.* When so mounted, sensor optical device component 11 and base optical device component 41 face each other in close proximity. *Id.* ¶ 66. In this position, pulse sensor 1 can output information to the base device through the coupled optical device components. *Id.* ¶ 67. Specifically, the pulse sensor CPU performs the controls necessary to transmit pulse information using infrared LED 23 to photodetector 45 of base device 17. *Id.* ¶¶ 67, 70, 76. In an alternative embodiment, additional sensor LEDs and base photodetectors can be used to efficiently transmit data and improve accuracy. *Id.* ¶ 111.

3. Overview of Ohsaki (Ex. 1009)

Ohsaki is a U.S. patent application publication titled "Wristwatch-type Human Pulse Wave Sensor Attached on Back Side of User's Wrist," and

discloses an optical sensor for detecting a pulse wave of a human body. Ex. 1009, code (54), ¶ 3. Figure 1 of Ohsaki is reproduced below.

FIG. 1

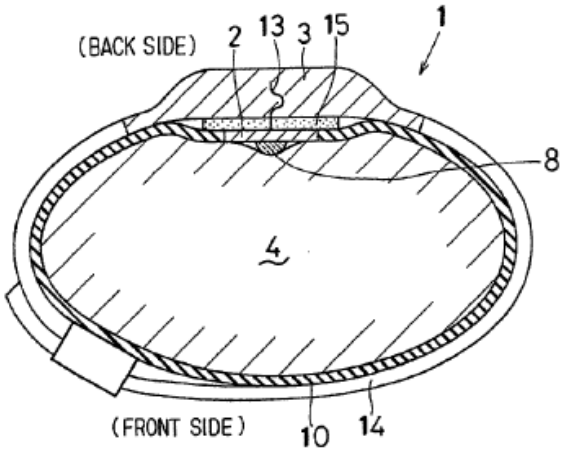


Figure 1 illustrates a cross-sectional view of pulse wave sensor 1 attached on the back side of user's wrist 4. *Id.* ¶¶ 12, 16. Pulse wave sensor 1 includes detecting element 2 and sensor body 3. *Id.* ¶ 16.

Figure 2 of Ohsaki, reproduced below, illustrates further detail of detecting element 2.

FIG. 2

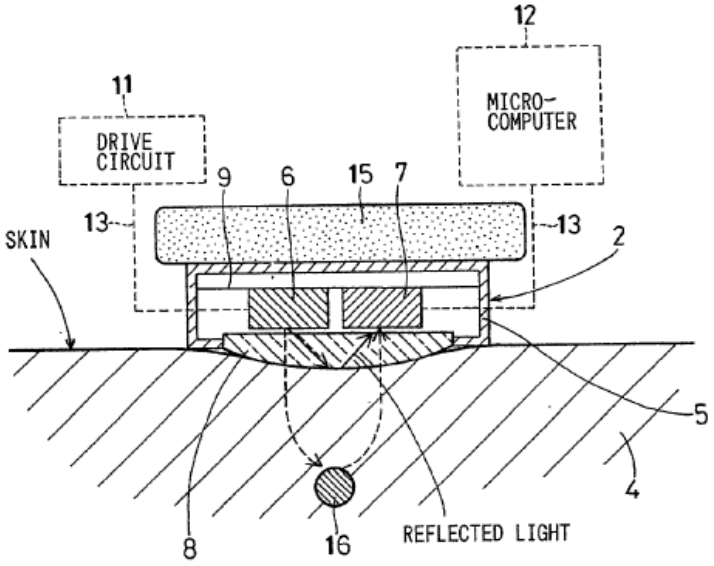


Figure 2 illustrates a mechanism for detecting a pulse wave. *Id.* ¶ 13. Detecting element 2 includes package 5, light emitting element 6, light receiving element 7, and translucent board 8. *Id.* ¶ 17. Light emitting element 6 and light receiving element 7 are arranged on circuit board 9 inside package 5. *Id.* ¶¶ 17, 19.

"[T]ranslucent board 8 is a glass board which is transparent to light, and attached to the opening of the package 5. A convex surface is formed on the top of the translucent board 8." *Id.* ¶ 17. "[T]he convex surface of the translucent board 8 is in intimate contact with the surface of the user's skin," preventing detecting element 2 from slipping off the detecting position of the user's wrist. *Id.* ¶ 25. By preventing the detecting element from moving, the convex surface suppresses "variation of the amount of the reflected light which is emitted from the light emitting element 6 and reaches the light receiving element 7 by being reflected by the surface of the user's skin." *Id.* Additionally, the convex surface prevents penetration by "noise such as disturbance light from the outside." *Id.*

Sensor body 3 is connected to detecting element 2 by signal line 13. *Id.* ¶ 20. Signal line 13 connects detecting element 2 to drive circuit 11, microcomputer 12, and a monitor display (not shown). *Id.* Drive circuit 11 drives light emitting element 6 to emit light toward wrist 4. *Id.* Detecting element 2 receives reflected light which is used by microcomputer 12 to calculate pulse rate. *Id.* "The monitor display shows the calculated pulse rate." *Id.*

4. Mendelson-2006 (Ex. 1010)

Mendelson-2006 is a journal article titled "A Wearable Reflectance Pulse Oximeter for Remote Physiological Monitoring," and discloses a

wireless wearable pulse oximeter connected to a personal digital assistant ("PDA"). Ex. 1010, 1.[3]

Figure 1 of Mendelson-2006 is reproduced below.

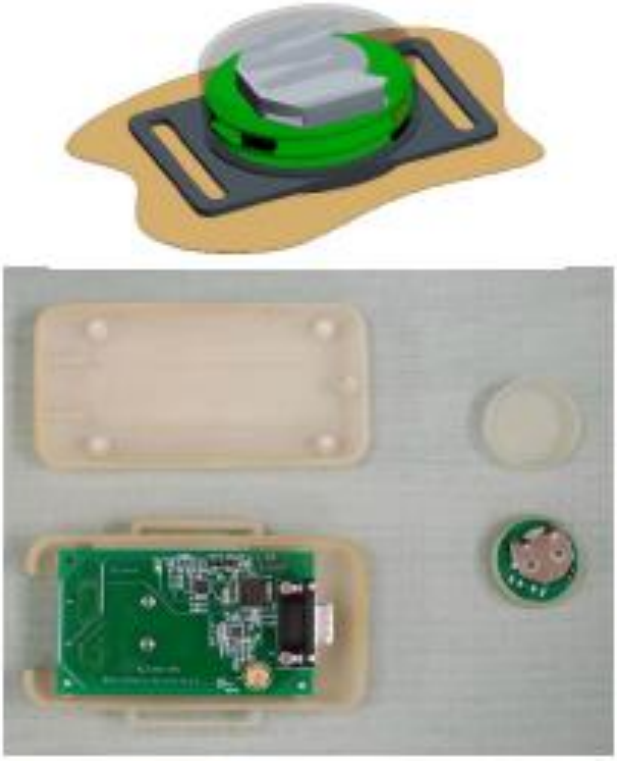


Figure 1 illustrates a sensor module attached to the skin (top), and a photograph of a disassembled sensor module and receiver module (bottom). The sensor module includes an optical transducer, a stack of round printed circuit boards, and a coin cell battery. *Id.* at 2.

[3] Petitioner cites to the page numbers added to Exhibit 1010, rather than the native page numbering that accompanies the article. *See, e.g.*, Pet. 20–22. We follow Petitioner's numbering scheme.

Figure 2 of Mendelson-2006 is reproduced below.

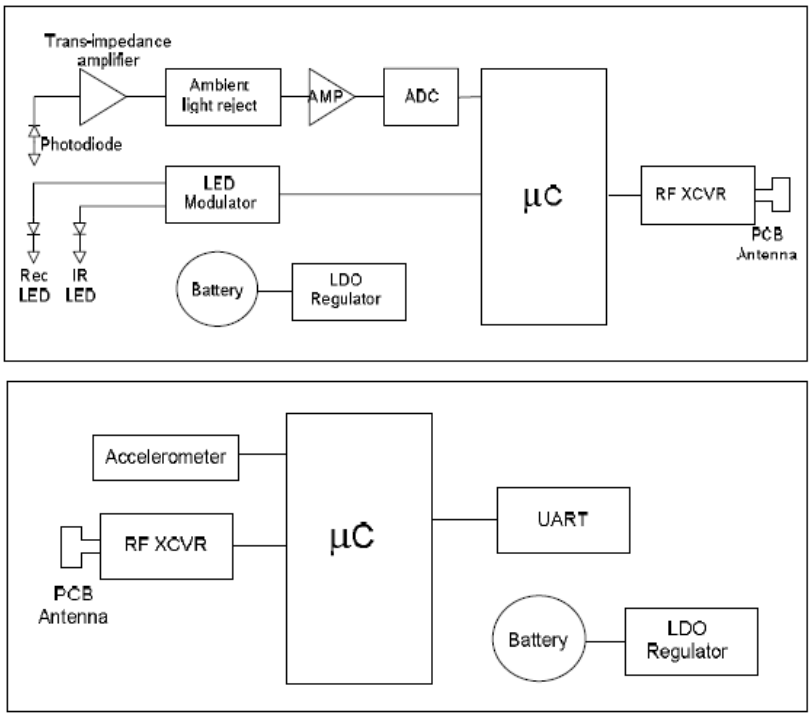


Figure 2 depicts a system block diagram of the wearable, wireless, pulse oximeter including the sensor module (top) and the receiver module (bottom). *Id.* The sensor module includes at least one light-emitting diode ("LED"), a photodetector, signal processing circuitry, an embedded microcontroller, and an RF transceiver. *Id.* at 1–2. Mendelson-2006 discloses that a concentric array of discrete photodetectors could be used to increase the amount of backscattered light detected by a reflectance type pulse oximeter sensor. *Id.* at 4. The receiver module includes an embedded microcontroller, an RF transceiver for communicating with the sensor module, and a wireless module for communicating with the PDA. *Id.* at 2.

As a PDA for use with the system, Mendelson-2006 discloses "the HP iPAQ h4150 PDA because it can support both 802.11b and Bluetooth™ wireless communication" and "has sufficient computational resources." *Id.* at 3. Mendelson-2006 further discloses that

> [t]he use of a PDA as a local terminal also provides a low-cost touch screen interface. The user-friendly touch screen of the PDA offers additional flexibility. It enables multiple controls to occupy the same physical space and the controls appear only when needed. Additionally, a touch screen reduces development cost and time, because no external hardware is required. . . . The PDA can also serve to temporarily store vital medical information received from the wearable unit.

Id.

The PDA is shown in Figure 3 of Mendelson-2006, reproduced below.

Figure 3 illustrates a sample PDA and its graphical user interface ("GUI"). *Id.* Mendelson-2006 explains that the GUI allows the user to interact with the wearable system. *Id.* "The GUI was configured to present the input and output information to the user and allows easy activation of various functions." *Id.* "The GUI also displays the subject's vital signs, activity level, body orientation, and a scrollable PPG waveform that is transmitted by the wearable device." *Id.* For example, the GUI displays numerical oxygen saturation ("SpO_2") and heart rate ("HR") values. *Id.*

5. Independent Claim 1

Petitioner contends that claim 1 would have been obvious over the combined teachings of Aizawa, Inokawa, Ohsaki, and Mendelson-2006. Pet. 11–62. Below, we set forth how the combination of prior art references teaches or suggests the claim limitations that are not disputed by the parties. For those limitations and reasons for combining the references that are disputed, we examine each of the parties' contentions and then provide our analysis.

i. "A physiological measurement system comprising"

The cited evidence supports Petitioner's undisputed contention that Aizawa satisfies the subject matter of the preamble.[4] Pet. 38; *see, e.g.*, Ex. 1006 ¶ 2 ("The present invention relates to a pulse wave sensor for detecting the pulse wave of a subject.").

ii. "[a] a physiological sensor device comprising"

The cited evidence supports Petitioner's undisputed contention that Aizawa discloses a physiological sensor device including a pulse rate detector. Pet. 38–41; *see, e.g.*, Ex. 1006 ¶ 23 (pulse wave sensor 2), Figs. 1(a)–(b).

[4] Whether the preamble is limiting need not be resolved because Petitioner shows sufficiently that the preamble's subject matter is satisfied by the art.

iii. "[b] one or more emitters configured to emit light into tissue of a user"

Petitioner's Undisputed Contentions

Petitioner contends that Aizawa discloses one emitter—LED 21—and also states that, in certain embodiments, multiple LEDs may be employed. Pet. 11, 20–21. Patent Owner does not dispute this contention, and we agree with Petitioner that Aizawa discloses "one or more emitters" as claimed. *See* Ex. 1006 ¶¶ 23 ("LED 21"), 32 ("The arrangement of the light emitting diode 21 and the photodetectors 22 is not limited to this."). For example, Aizawa explains that "[t]he same effect can be obtained when the number of photodetectors 22 is 1 and a plurality of light emitting diodes 21 are disposed around the photodetector." *Id.* ¶ 33.

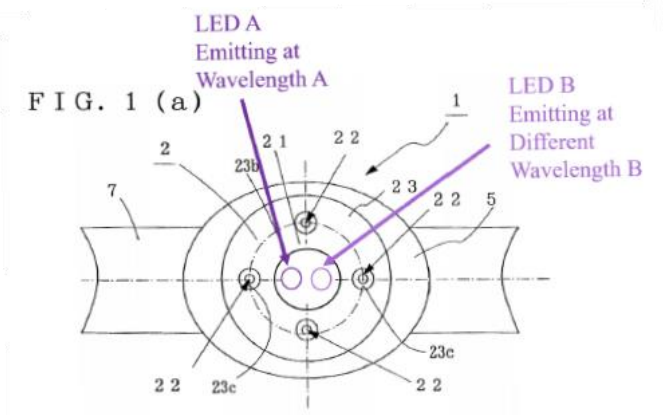
Petitioner also contends that Inokawa teaches a sensor with two LEDs–a green LED to sense pulse and an infrared LED to sense body motion. Pet. 14, 20. Petitioner also contends that when Inokawa's sensor is mounted on a base device, the infrared LED also is used to wirelessly transmit vital information to the base device. *Id.* at 14–15, 20–21. Patent Owner does not dispute these contentions, and we agree with Petitioner. Inokawa teaches a pair of LEDs 21, 23, where "the basic function of the S-side green LED 21 is to sense the pulse from the light reflected off of the body . . ., while the S-side infrared LED 23 serves to sense body motion from the change in this reflected light." Ex. 1008 ¶¶ 58–59. Inokawa also explains that "vital sign information stored in the memory 63 [of the sensor], such as pulse and body motion, is transmitted to the base device 17 using the S-side infrared LED 23 of the pulse sensor 1 and the B-side PD 45 of the base device 17," such that "there is no need to use a special wireless communication circuit or a communication cable." *Id.* ¶¶ 76–77.

Petitioner's Disputed Contentions

Moreover, Petitioner contends that a person of ordinary skill in the art would have been motivated to modify Aizawa "to include an additional LED as taught by Inokawa to improve the detected pulse wave by distinguishing between blood flow detection and body movement." Pet. 20, 42–43. According to Dr. Kenny, "[i]n this manner, Aizawa's sensor is improved by using a separate LED to account for motion load that the system already records and accounts for." Ex. 1003 ¶ 85.

As a second and independent motivation, Petitioner also contends that such a modification also would have provided "additional functionality, including that of a wireless communication method," which would have "eliminate[d] problems associated with a physical cable, and, as taught by Inokawa, without requiring a separate RF circuit." Pet. 20–21. Petitioner contends that although Aizawa discloses data transmission, Aizawa "is silent about how such transmission would be implemented." *Id.* at 21. According to Petitioner, a skilled artisan "would have recognized that Aizawa's LED could have been used for wireless data communication with a personal computer to eliminate problems associated with a physical cable, and, as taught by Inokawa, without requiring a separate RF," which "would result in enhanced accuracy of the transmitted information." *Id.* According to Dr. Kenny, "the LEDs provided on the sensor can be used not only to detect pulse rate but also to 'accurately, easily, and without malfunction' transmit sensed data to a base station." Ex. 1003 ¶ 81.

To illustrate its proposed modification, Petitioner includes annotated and modified views of Aizawa's Figures 1(a) and 1(b), reproduced below. Pet. 22; *see also id.* at 42 (similar figures); Ex. 1003 ¶ 84.



Petitioner's annotated and modified figures depict the sensor of Aizawa with an added "LED B" (illustrated in light purple), as Petitioner contends would have been rendered obvious by Inokawa. *Id.* at 22, 42; Ex. 1003 ¶¶ 79–87, 109–110.

Patent Owner's Arguments

Patent Owner disputes Petitioner's contentions regarding the obviousness of modifying Aizawa to include two emitters. *See* PO Resp. 50–57; Sur-reply 23–25.

First, Patent Owner argues that neither Aizawa nor Inokawa discloses a device with both multiple detectors *and* multiple emitters in the *same* sensor, because Aizawa's embodiments have either a single emitter and multiple detectors (e.g., Ex. 1006, Fig. 1(a)) or multiple emitters and a single

detector (e.g., *id.* ¶ 33), and Inokawa discloses multiple emitters and a single detector (e.g., Ex. 1008, Fig. 2). *See* PO Resp. 50–51 (citing, e.g., Ex. 1006 ¶ 33, Figs. 1, 2, 4, 5; Ex. 1008 ¶ 58, Fig. 2; Ex. 2004 ¶¶ 100–102). Patent Owner concludes, therefore, that there would have been no reason for a person of ordinary skill in the art to add a second emitter to Aizawa, when Aizawa already discloses an embodiment with multiple LEDs, i.e., an embodiment with only a single detector. PO Resp. 51 (citing, e.g., Ex. 2004 ¶ 103).

Second, Patent Owner argues that the evidence does not support either of Petitioner's two proffered motivations for modifying Aizawa to include two emitters. As to the first motivation (to measure body movement using a second emitter), Patent Owner asserts that Dr. Kenny erroneously testifies that Aizawa cannot do this with its single emitter. PO Resp. 51–52 (citing, e.g., Ex. 1006 ¶ 15; Ex. 2007, 400:7–401:10; Ex. 2004 ¶ 104). Patent Owner argues that "Petitioner admits that Aizawa's sensor 'already records and accounts for' motion load." *Id.* at 52 (citing, e.g., Pet. 20, 23; Ex. 1006 ¶ 28). Thus, Patent Owner contends that the proposed motivation would not realize an improvement over Aizawa alone. *Id.*

As to Petitioner's second motivation (to enable transmission of data to a base device using an optical communication link), Patent Owner argues that "Aizawa ***already*** includes a wireless transmitter . . . so Aizawa does not need to incorporate Inokawa's base-device [optical] data transmission arrangement." PO Resp. 53 (citing, e.g., Ex. 1006 ¶¶ 23, 28, 35; Ex. 2004 ¶¶ 105–106). Indeed, Patent Owner argues "Dr. Kenny acknowledged Aizawa identifies no problems with Aizawa's form of data transmission." *Id.* (citing Ex. 2007, 409:13–410:2). Patent Owner further argues that

"Aizawa's goal is 'real-time measuring' with the transmitter 'transmitting the measured pulse rate data to a display'" but that "Inokawa's data transfer approach does ***not*** allow real-time display of measurements." *Id.* at 53–54 (citing, e.g., Ex. 1006 ¶¶ 4, 15; Ex. 1008 ¶¶ 70, 74; Ex. 2004 ¶ 107). Patent Owner insists Inokawa does not aid Petitioner's case, because Inokawa discloses the benefits of using a second emitter in only two situations, i.e., first, to improve over a "mechanically-connected system," e.g., with a cable for communication, and, second, to avoid use of a "dedicated wireless communication circuit," whereas "Aizawa ***already*** incorporates a transmitter into its design." *Id.* at 54–55 (citing, e.g., Ex. 1008 ¶ 4; Ex. 1006 ¶¶ 16, 23, 28, 35; Ex. 2004 ¶ 108).

Third, Patent Owner accuses Petitioner and Dr. Kenny of overlooking further complications that would ensue from modifying Aizawa to have two emitters. Patent Owner argues that Dr. Kenny overlooked how placing "two LEDs in close proximity may cause thermal interference that could create significant issues for sensor performance," and would require "structural changes" to Aizawa's configuration. PO Resp. 56 (citing, e.g., Ex. 2004 ¶¶ 109–110; Ex. 1019, 76–77). Patent Owner also argues that "Petitioner widened Aizawa's emitter cavity to accommodate the extra LED with ***no*** explanation or recognition of this change," which could impact optical performance of the device. *Id.* at 56–57 (citing, e.g., Ex. 2004 ¶¶ 109–111).

Petitioner's Reply

Concerning Petitioner's first motivation, Petitioner asserts that adding an additional LED enables the sensor to distinguish between blood flow and body movement, which provides a "more reliable" pulse measurement, which is Petitioner's asserted improvement to Aizawa. Pet. Reply 34

(citing, e.g., Ex. 1003 ¶¶ 79–86; Ex. 2007, 401:11–402:4; Ex. 1047 ¶ 70). Moreover, Petitioner contends that by using multiple LEDs at different wavelengths, "two separate signals" can be collected, which "allows noise arising from body motion to be better isolated and accounted for." *Id.* (citing Ex. 1047 ¶ 70).

Concerning Petitioner's second motivation, Petitioner maintains that Inokawa's use of two emitters having different wavelengths to upload data to a base device using optical communication advantageously improves the accuracy of the transmission by providing checksum information. *Id.* at 34–35 (citing, e.g., Ex. 1003 ¶ 70; Ex. 1008 ¶ 111; Ex. 2007, 407:7–408:20, 416:5–15; Ex. 1047 ¶ 71).

As to the "other complications" that Patent Owner alleges would result from the proposed modification, Petitioner asserts "such issues are 'part of what [a person of ordinary skill in the art] would bring . . . to the problem and would know how to make the changes needed.'" *Id.* at 35 (quoting Ex. 2007, 384:8–388:12; Ex. 1047 ¶ 72).

Patent Owner's Sur-reply

Concerning Petitioner's first motivation, Patent Owner argues that Inokawa's disclosure is just as sparse as Aizawa's disclosure regarding how to use optical data to measure body movement. Sur-reply 24 (citing Ex. 1008 ¶ 59). Patent Owner also asserts that "Petitioner cites nothing in Inokawa that suggests" that Inokawa's two emitter data gathering is more reliable or otherwise superior to Aizawa's single emitter data gathering. *Id.*

Concerning Petitioner's second motivation, Patent Owner argues that the proposed modification eliminates Aizawa's ability to conduct "***real-time***

collection and display of physiological measurements—a key goal of Aizawa's system." *Id.* at 24–25.

Patent Owner also notes that Petitioner does not dispute that the proposed modification would cause problems such as "additional cost, energy use, and thermal problems" that would ensue from using two emitters in the Aizawa device. *Id.*

Analysis

Upon review of the foregoing, we conclude a preponderance of the evidence supports Petitioner's contention that it would have been obvious to replace Aizawa's single near infrared LED 21 with an infrared LED and a green LED, in light of Inokawa.

First, a person of ordinary skill in the art would have been motivated to make this replacement to improve the pulse measurements recorded by Aizawa's detector 1. Inokawa teaches that the infrared LED's signal can be used "to detect vital signs" such as "body motion," and the green LED's signal can be "used to detect pulse." Ex. 1008, Fig. 2, ¶¶ 14, 58–59; Ex. 1003 ¶¶ 68, 80, 83–85; Ex. 1047 ¶¶ 69–70.

Patent Owner correctly points out that Aizawa describes its single-emitter detector 1 as transmitting its pulse data to "a device for computing the amount of motion load from the pulse rate." Ex. 1006 ¶¶ 15, 28, 35. But, this description is the only disclosure in Aizawa cited by Patent Owner as relating to computing a motion characteristic of the user. Further, we are unable to discern any other disclosure in Aizawa relating to motion computation, or what Aizawa proposes to do with its motion computation. *See id.* Based on the sparse nature of Aizawa's disclosure concerning motion load, it is not clear exactly what Aizawa proposes to do with the

computed motion load, after it is computed. *See, e.g.*, Ex. 1047 ¶ 70 ("Aizawa is silent on whether it uses the computed motion load to improve the detection signal."). Aizawa does, however, describe the motion load as being computed "from the pulse rate," rather than being an input to the pulse rate calculation. Ex. 1006 ¶¶ 15, 35.

In a deposition for other proceedings related to this *inter partes* review, *see supra* § I.B, Dr. Kenny was asked whether it was his understanding that "Aizawa's sensor could not account for motion load?"; Dr. Kenny answered that "Aizawa's sensor attempts to prevent motion load rather than account for it." Ex. 2007, 400:7–11 (deposition for IPR2020-01520, IPR2020-01537, and IPR2020-01539). He explained that, because Aizawa uses only a single emitter with a single wavelength, "what [Aizawa] sees as a signal would be some mixture of pulse rate and motion load if there was no effort to prevent motion load," so Aizawa seeks to solve the problem of "prevent[ing] motion load from corrupting the pulse rate signal." *Id.* at 400:12–401:10. Dr. Kenny did not further explain this distinction between preventing and accounting for motion load in his deposition testimony cited by the parties as relating to this issue. *Id.* at 400:7–402:4. We do not rely on this distinction as a basis for our present decision, because we find no express support for it in Aizawa's disclosure (*see* Ex. 1006 ¶¶ 15, 28, 35), and it is not explained in persuasive detail by Dr. Kenny.

We nonetheless credit Dr. Kenny's declaration testimony that a person of ordinary skill in the art, upon reviewing Inokawa's disclosure of using two emitters of different wavelengths to calculate a user's pulse and motion separately, would understand that these two separate measurements would enable the device to calculate a "more reliable" pulse rate because it "allows

noise arising from body motion to be better isolated and accounted for." Ex. 1047 ¶ 70; Ex. 1003 ¶¶ 80, 83, 85, 109–110. Aizawa does not disclose using the computed motion load in this fashion, so it appears that this would improve upon the accuracy of Aizawa's pulse measurements, by using the computed motion load to isolate and account for noise. *See* Ex. 1006 ¶¶ 15, 28, 35.

Dr. Madisetti also offers no meaningful opposing testimony in this regard. *See, e.g.*, Ex. 2004 ¶ 104. Instead, Dr. Madisetti incorrectly reads Dr. Kenny's motivation testimony as being limited to the desirability of adding the bare ability to measure body movement to Aizawa. *See id.* In fact, Dr. Kenny further testified that it would have been beneficial to *use* the measured body movement to *improve* the pulse measurement of the device. *See* Ex. 1003 ¶¶ 80, 83, 85; Ex. 1047 ¶ 70. Dr. Madisetti does not address that testimony. *See* Ex. 2004 ¶ 104.

Thus, because Dr. Madisetti's testimony sets up a straw man to attack, rather than directly addressing the entirety of Dr. Kenny's testimony in this regard, Dr. Kenny's testimony stands unrebutted in the record before us. Dr. Kenny's testimony also makes intuitive sense that measuring the user's motion *separately* from the user's pulse, for example by using two interrogating emitters of two different wavelengths, would provide a reliable means of correcting the pulse data for motion artifacts by using the separately measured motion data, rather than by trying to segregate these two components in the single data stream provided by Aizawa's single emitter device. *See, e.g.*, Ex. 1047 ¶ 70. We, therefore, are persuaded by Dr. Kenny's unrebutted testimony that using two emitters of different wavelengths would improve Aizawa's device in this way.

Independently, we are also persuaded that a person of ordinary skill in the art would have been motivated to replace Aizawa's single near infrared LED 21 with an infrared LED and a green LED, to provide a reliable method of uploading pulse data stored by Aizawa's wrist-worn pulse rate detector 1 to another device for display to the user. Inokawa expressly touts such optically-based uploading of data from Inokawa's wrist-worn sensor 1 to Inokawa's base device 17 as a benefit of incorporating two emitters in sensor 1. *See* Ex. 1008, Figs. 3, 19, ¶¶ 3–7, 14, 76–77, 109–111. Inokawa identifies two specific benefits of this optically-based data communication means. First, the infrared LED can transmit the pulse data, and the green LED can separately transmit "checksum" information to increase the accuracy of data transmission. *Id.* at Fig. 19, ¶¶ 14, 109–111. Second, using light emitters in this fashion to perform two functions (data collection by emitting light into the user's wrist, and data transmission by emitting light to photodetectors in a base device) obviates the need for providing "a special wireless communication circuit [in the wrist-worn sensor 1] or a communication cable." *Id.* ¶¶ 3–7, 76–77.

Patent Owner correctly points out that Aizawa already has a "transmitter" 4 for uploading pulse data stored by Aizawa's wrist-worn pulse rate detector 1 to another device for processing and for display to the user. Ex. 1006, Fig. 1(b), ¶¶ 15, 23, 28, 35. However, Aizawa's Figure 1(b) illustrates transmitter 4 only as an empty box contained within outer casing 5, and Aizawa's written description does not provide further structural details concerning transmitter 4. *See id.* In particular, Aizawa does not describe exactly how transmitter 4 transmits its data to the other device. *See id.*

Patent Owner contends, and Dr. Madisetti and Dr. Kenny both testify, that Aizawa's transmitter 4 is a "wireless" transmitter. *See, e.g.*, PO Resp. 53; Ex. 2004 ¶¶ 49, 105–106, 112; Ex. 2007, 403:17–22, 414:19–21. They all appear to equate "wireless" communication to radio frequency communication, and not to include optical communication, even though both radio frequency and optical communication do not use a wire. Based on the foregoing testimony, we assume, for this decision, that Aizawa contemplates radio frequency communication as one embodiment by which transmitter 4 may transmit data to devices other than detector 1.

Patent Owner argues, and Dr. Madisetti testifies, that Aizawa's express disclosure goes even further. They assert Aizawa's "goal" is to measure and display pulse data *in real time during exercise,* using the wireless transmitter. *See*, *e.g.*, Ex. 2004 ¶¶ 106–108, 111. We find that Aizawa does not support this assertion. Instead, Aizawa discusses prior art devices that "estimat[e] a burden on the heart of a person who takes exercise by *real-time measuring* his/her heart rate at the time of exercise" (Ex. 1006 ¶ 4 (emphasis added)), and then describes Aizawa's detector 1 as having a transmitter for transmitting the measured pulse rate data to another device for display (*id.* ¶ 15). Aizawa does not indicate when this transmission occurs. Aizawa also refers to "noise caused by the shaking of the body of the subject" as a problem to be addressed (*id.* ¶ 6), but this problem occurs regardless of whether the shaking results from exercise or the normal movement of the user's wrist over the course of the day. Thus, Aizawa does not tout, as an important feature of Aizawa's invention, the *real time display* of pulse rate data during exercise, regardless of whether the data gathered by

Aizawa's wrist-worn detector 1 is transmitted wirelessly or otherwise. *Id.* ¶¶ 4, 6, 15.

No doubt, a person of ordinary skill in the art would have viewed the capability of a wrist-worn pulse detector to transmit its pulse data to another device for display in real time while the user is exercising to be a desirable feature in some cases, even if this is not one of Aizawa's specifically stated goals. *See, e.g.*, Ex. 1003 ¶ 72 (Dr. Kenny stating: "By wirelessly transmitting the collected data, the condition of a subject can be determined 'remotely' . . . ."); Ex. 2009, 393:6–14 (in a deposition for other related proceedings, Dr. Kenny agreeing that a person of ordinary skill in the art "would have seen the ability to wirelessly transmit collected data as an advantage"). Nonetheless, Inokawa expressly discloses that, in other cases, the benefits achieved by wireless transmission can be outweighed by obviating the need for the wrist-worn sensor to include a special wireless communication circuit. *See* Ex. 1008 ¶¶ 3–7 (discussing problems associated with wireless transmission, such as the need for a dedicated circuit, which is avoided by Inokawa's system that risks "few malfunctions" and has a "simple structure"), 76–77 ("As a result, there is no need to use a special wireless communication circuit . . ., which makes it possible to transmit vital sign information to the base device 17 accurately, easily, and without malfunction."). We therefore conclude that Petitioner's case for obviousness in this regard is supported by a preponderance of the evidence. *See, e.g.*, *In re Urbanski*, 809 F.3d 1237, 1243–44 (Fed. Cir. 2016) (persons of ordinary skill in the art may be motivated to pursue desirable properties of one prior art reference, even at the expense of foregoing a benefit taught by another prior art reference).

We disagree with Patent Owner's argument that Petitioner's case for obviousness is deficient on the basis that neither Aizawa nor Inokawa expressly discloses a wrist-worn sensor device that has *both* a plurality of emitters *and* at least four detectors, as claim 1 recites. Obviousness does not require "'some motivation or suggestion to combine the prior art teachings' [to] be found in the prior art." *KSR*, 550 U.S. at 407, 415–418. Nor does it require the bodily incorporation of Inokawa's device into Aizawa's device. *See, e.g.*, *In re Keller*, 642 F.2d 413, 425 (CCPA 1981) (test for obviousness is not whether the features of one reference may be bodily incorporated into the structure of the other reference, but rather is "what the combined teachings of the references would have suggested to those of ordinary skill in the art"); *see also In re Merck & Co.*, 800 F.2d 1091, 1097 (Fed. Cir. 1986) (nonobviousness is not established by attacking references individually when unpatentability is predicated upon a combination of prior art disclosures). Instead, "[a] person of ordinary skill is also a person of ordinary creativity, not an automaton," and "in many cases a person of ordinary skill will be able to fit the teachings of multiple patents together like pieces of a puzzle." *KSR*, 550 U.S. at 420–421.

In this case, we are persuaded that a person of ordinary skill in the art would have been motivated to modify Aizawa's wrist-worn detector 1 to replace its single near infrared LED 21 with an infrared LED and a green LED, based on Inokawa, for all the reasons provided above. A person of ordinary skill in the art would additionally have known to keep all four detectors 22 that are already present in Aizawa's detector 1, so that "[e]ven when the attachment position of the sensor is dislocated, a pulse wave can be detected accurately," as disclosed by Aizawa. Ex. 1006 ¶¶ 9, 27. In short,

the combination of Aizawa and Inokawa teaches that having multiple emitters is beneficial, and having multiple detectors is beneficial, for different and not inconsistent reasons.

Finally, we agree with Petitioner's position that any thermal interference and power consumption issues that may arise in Aizawa's wrist-worn pulse detector, by using two emitters instead of one emitter, are well within the capabilities of a person of ordinary skill in the art to solve. We credit Dr. Kenny's testimony in this regard. *See* Ex. 1003 ¶ 86; Ex. 1047 ¶ 72. For example, Dr. Kenny acknowledges that Aizawa already discloses adding additional emitters. Ex. 1003 ¶ 79 (citing Ex. 1006 ¶¶ 32–33). Dr. Kenny further testifies that this modification "amount[s] to nothing more than the use of a known technique [i.e., Inokawa's use of two emitters in a wrist-worn pulse detector] to improve similar devices [i.e., Aizawa's wrist-worn pulse detector] in the same way and combining prior art elements according to known methods to yield predictable results." *Id.* ¶ 86.

Patent Owner cites portions of Dr. Kenny's deposition testimony that, in Patent Owner's view, indicate Dr. Kenny fails to appreciate the significance of optical interference complications posed by adding a second emitter to Aizawa's device, and fails to explain how this would have been overcome. *See* PO Resp. 56–57 (citing Ex. 2007, 394:11–395:17). We have reviewed this deposition testimony, and we conclude Patent Owner overstates its significance. It establishes, at most, that Dr. Kenny did not expressly address this issue in his declaration (Exhibit 1003), but Dr. Kenny's opinion is that this would have been within the capability of a person of ordinary skill in the art to resolve. Based on the evidentiary record presented to us, we agree with Dr. Kenny. For example, Inokawa discloses a

wrist-worn pulse sensor 1 having two emitters 21 and 23 in close proximity to each other. *See* Ex. 1008, Figs. 1–2. An artisan must be presumed to know something about the art apart from what the relied-upon references disclose. *See In re Jacoby*, 309 F.2d 513, 516 (CCPA 1962).

Dr. Madisetti's testimony opposing Dr. Kenny's foregoing opinion is premised solely on Dr. Kenny's alleged failure to explain how issues that arise from adding a second emitter to Aizawa would have been solved; Dr. Madisetti does not provide any affirmative reason why these issues would have been difficult for a person of ordinary skill in the art to solve, in the context of Aizawa's device or wrist-worn pulse sensing devices in general. *See* Ex. 2004 ¶ 109.

Thus, we conclude a person of ordinary skill in the art would have been motivated to replace Aizawa's single near infrared LED 21 with an infrared LED and a green LED, and would have had a reasonable expectation of success in doing so.

iv. "[c] at least four detectors, wherein each of the at least four detectors has a corresponding window that allows light to pass through to the detector"

The cited evidence supports Petitioner's undisputed contention that Aizawa discloses at least four detectors, each stored in a separate cavity 23c, which would have been understood to be "openings or windows that mirror specific detector placement layouts." Pet. 48, 43–49; *see, e.g.*, Ex. 1006 ¶¶ 23 ("four phototransistors 22"), 24 ("stored in cavities" and "set back from . . . detection face 23a"), Figs. 1(a)–1(b); Ex. 1003 ¶¶ 111–119.

v. "[d] a wall that surrounds at least the at least the four detectors"

The cited evidence supports Petitioner's undisputed contention that Aizawa discloses holder 23, which is a wall that surrounds detectors 22, as well as other elements. Pet. 50–51; *see, e.g.*, Ex. 1006 ¶ 23 ("holder 23 for storing . . . light emitting diode 21 and the photodetectors 22"), Fig. 1(b).

vi. "[e] cover comprising a protruding convex surface, wherein the protruding convex surface is above all of the at least four detectors, wherein at least a portion of the protruding convex surface is rigid, and wherein the cover operably connects to the wall;"

Petitioner's Undisputed Contentions

Petitioner contends that Aizawa discloses a cover, i.e., "an acrylic transparent plate positioned between the photodetectors and the wrist," to improve adhesion between the sensor and the subject's wrist. Pet. 13. Patent Owner does not dispute this contention, and we agree with Petitioner. Aizawa discloses that "acrylic transparent plate 6 is provided on the detection face 23a of the holder 23 to improve adhesion to the wrist 10." Ex. 1006 ¶ 34, Fig. 1(b) (depicting transparent plate 6 between sensor 2 and wrist 10).

Petitioner also contends that Ohsaki teaches a wrist-worn sensor that includes a "translucent board" having a convex surface that contacts the user's skin. Pet. 16, 31. Patent Owner does not dispute this contention, and we agree with Petitioner. Ohsaki discloses that sensor 1 includes detecting element 2 and sensor body 3, and is "worn on the back side of the user's wrist." Ex. 1009 ¶ 16. Ohsaki discloses that detecting element 2 includes package 5 and "translucent board 8[,which] is a glass board which is transparent to light, [and is] attached to the opening of the package 5. A

convex surface is formed on the top of the translucent board 8." *Id.* ¶ 17. As seen in Ohsaki's Figure 2, translucent board 8 has a protruding convex surface, and is located above all of the detectors. *Id.* at Fig. 2. As also seen in Figure 2, the cover is operably connected to the walls of sensor package 5. *Id.* ¶ 17 ("The translucent board 8 is . . . attached to the opening of the package 5."), Fig. 2.

Petitioner also contends that Ohsaki's Figure 2 depicts the user's tissue conforming to the shape of the convex surface of the cover, such that the convex surface would have been "rigid." Pet. 53. Patent Owner does not dispute this contention, and we agree with Petitioner. Ohsaki's Figure 2 depicts the user's tissue 4 conforming to the shape of the protruding convex surface when the sensor is worn by the user. Ex. 1009 ¶ 17 ("The translucent board 8 is a glass board."), Fig. 2; *see, e.g.*, Ex. 1003 ¶ 124.

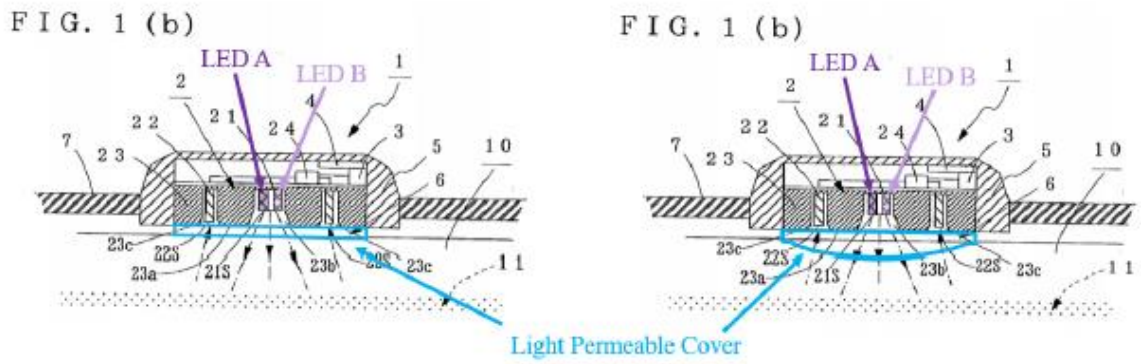
Petitioner's Disputed Contentions

Petitioner further contends that a person of ordinary skill in the art would have found it obvious "to modify the sensor's flat cover [in Aizawa] . . . to include a lens/protrusion . . . similar to Ohsaki's translucent board 8, so as to [1] improve adhesion between the user's wrist and the sensor's surface, [2] improve detection efficiency, and [3] protect the elements within sensor housing." Pet. 33, 52 (citing, e.g., Ex. 1003 ¶¶ 25, 100–101; Ex. 1006 ¶¶ 2, 5, 8–16, 23–24, 27–29, 32–33). Petitioner contends that Ohsaki's convex surface is in "intimate contact" with the user's tissue, which prevents slippage of the sensor and increases signal strength because "variation of the amount of the reflected light . . . that reaches the light receiving element 7 is suppressed" and because "disturbance light from the outside" is prevented from penetrating board 8, as compared to a sensor with

a flat surface. *Id.* at 31–32 (citing, e.g., Ex. 1003 ¶ 99; quoting Ex. 1009 ¶ 25). Petitioner also contends that, in the combination, the protruding convex surface would have been rigid, and the cover would have operably connected to the wall, as taught by Ohsaki. Pet. 52–53.

Petitioner contends this modification would have been "nothing more than the use of a known technique to improve similar devices in the same way," i.e., "simply improving Aizawa-Inokawa's transparent plate 6 that has a flat surface to improve adhesion to a subject's skin and reduce variation in the signals detected by the sensor." Pet. 34 (citing Ex. 1003 ¶ 102). Further according to Petitioner, "the elements of the combined system would each perform functions they had been known to perform prior to the combination—Aizawa-Inokawa's transparent plate 6 would remain in the same position, performing the same function, but with a convex surface as taught by Ohsaki." *Id.* at 34–35.

To illustrate its proposed modification, Petitioner includes two annotated versions of Aizawa's Figure 1(b), both of which are reproduced below. Pet. 34.



Petitioner's annotated figure on the left depicts Aizawa's sensor, modified to include LED B (*see supra* Section II.D.5.iii) and with a flat "light permeable cover" (illustrated with blue outline); Petitioner's annotated figure on the

right depicts Aizawa's sensor, again modified to include LED B (*see supra* Section II.D.5.iii) and with a convex "light permeable cover" (also illustrated with blue outline).

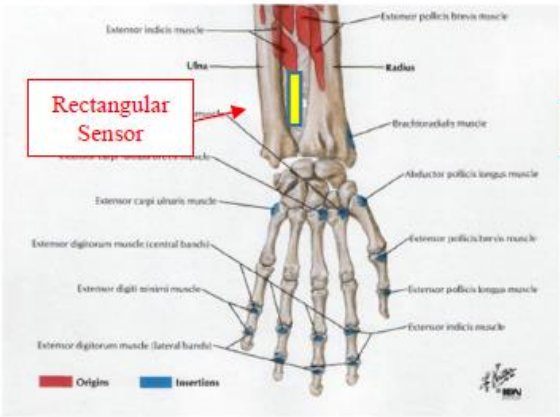
Patent Owner's Arguments

Patent Owner argues that a person of ordinary skill in the art would not have been motivated to modify Aizawa's sensor to include Ohsaki's convex cover. PO Resp. 19–50; PO Sur-reply 3–23.

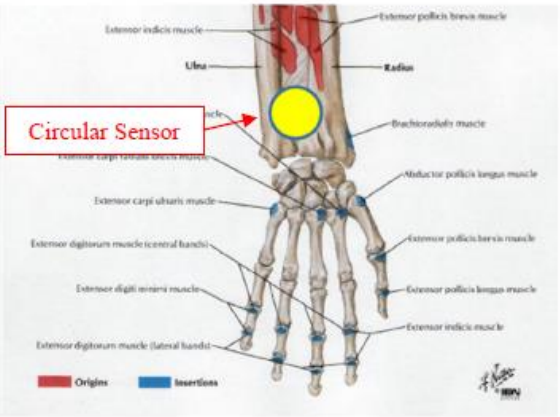
First, Patent Owner argues that the proposed modification "fundamentally changes Ohsaki's structure and eliminates the longitudinal shape that gives Ohsaki's translucent board the ability to prevent slipping." PO Resp. 20. This argument is premised on Patent Owner's contention that Ohsaki's convex cover must be rectangular, with the cover's long direction aligned with the length of the user's forearm, to avoid interacting with bones in the wrist and forearm. *Id.* at 22–24 (citing, e.g., Ex. 2004 ¶¶ 52–57; Ex. 1009 ¶¶ 6, 19, 23, 24); PO Sur-reply 3–11. According to Patent Owner, Ohsaki teaches that "aligning the sensor's longitudinal direction with the circumferential direction of the user's arm undesirably results in 'a tendency [for Ohsaki's sensor] to slip off.'" PO Resp. 22–23 (citing Ex. 1009 ¶ 19).

Thus, Patent Owner contends that Petitioner's proposed modification would "chang[e] Ohsaki's rectangular board into a circular shape," which "would eliminate the advantages discussed above" because it "cannot be placed in ***any longitudinal*** direction and thus cannot coincide with the longitudinal direction of the user's wrist." *Id.* at 23 (citing Ex. 2004 ¶¶ 56–57). Patent Owner presents annotated Figures depicting what it contends is Ohsaki's disclosed sensor placement as compared to that of the proposed modification, reproduced below. *Id.* at 24.

Ohsaki's Longitudinal Teachings



Petitioner's Proposed Combination



Patent Owner's annotated Figure on the left depicts a rectangular sensor placed between a user's radius and ulna, while Patent Owner's annotated Figure on the right depicts a circular sensor placed across a user's radius and ulna. Based on these annotations, Patent Owner argues that the proposed "circular shape would press on the user's arm in all directions and thus cannot avoid the undesirable interaction with the user's bone structure," such that a skilled artisan "would have understood such a change would eliminate Ohsaki's benefit of preventing slipping." *Id.* (citing, e.g., Ex. 2004 ¶¶ 56–57).

Second, Patent Owner argues that Ohsaki requires its sensor be placed on the back of the user's wrist to achieve any benefits, but that such a location would have been unsuitable for Aizawa's sensor. PO Resp. 29–30. Specifically, Patent Owner argues that Aizawa's sensor must be worn on the palm side of the wrist, close to radial and ulnar arteries, which is the side opposite from where Ohsaki's sensor is worn. *Id.* at 29–34 (citing, e.g., Ex. 2004 ¶¶ 66–73). According to Patent Owner, Ohsaki teaches that the sensor's convex surface has a tendency to slip when placed on the palm side of the wrist, i.e., in the location taught by Aizawa. *Id.* at 35–38 (citing, e.g.,

Ex. 1009 ¶¶ 19, 23, 24; Ex. 2004 ¶¶ 74–80). Thus, Patent Owner argues that a person of ordinary skill in the art "would not have been motivated to use Ohsaki's longitudinal board—designed to be worn on the ***back side*** of a user's wrist—with Aizawa's ***palm-side*** sensor." *Id.* at 38. Similarly, Patent Owner argues that Aizawa teaches away from the proposed modification because Aizawa teaches that its flat acrylic plate improves adhesion on the palm side of the wrist, while Ohsaki teaches that its convex board "has a tendency to slip" on the palm side of the wrist. *Id.* at 39–41 (citing, e.g., Ex. 2004 ¶¶ 82–84).

Third, Patent Owner argues that a person of ordinary skill in the art would not have placed Ohsaki's convex cover over Aizawa's peripheral detectors because the convex cover would condense light toward the center and away from Aizawa's detectors, which would decrease signal strength. PO Resp. 41–48 (citing, e.g., Ex. 2004 ¶¶ 85–97). Patent Owner also contends that Petitioner and Dr. Kenny admitted as much in a related proceeding. *Id.* at 42–43 (citing, e.g., Ex. 2019, 45; Ex. 2020, 69–70). Patent Owner also relies on Figure 14B of the '765 patent to support its position. *Id.* at 43 (citing Ex. 1001, 36:3–6, 36:13–15). Additionally, Patent Owner argues that its position is also supported by Inokawa, which also uses a convex lens to direct light toward the center but, in Inokawa's structure, the light is directed from peripheral emitters toward a central detector. *Id.* at 47–48 (citing, e.g., Ex. 1008 ¶¶ 15, 58). In light of the foregoing, Patent Owner argues that a person of ordinary skill in the art would have understood that the proposed modification would have decreased signal strength by directing light away from Aizawa's peripheral detectors. *Id.* at 45–48.

Fourth and finally, Patent Owner argues that a person of ordinary skill in the art "would have understood that Aizawa's ***flat*** plate would provide better protection than a convex surface" because it "would be less prone to scratches." *Id.* at 49–50 (citing Ex. 1008 ¶ 106).

Petitioner's Reply

Concerning Patent Owner's first and second arguments, Petitioner responds that Ohsaki does not disclose the shape of its protrusion, other than its convexity as shown in Figures 1 and 2, nor does Ohsaki require a rectangular shape or placement on the back of the wrist in order to achieve the disclosed benefits. Pet. Reply 13–21 (citing, e.g., Ex. 1047 ¶¶ 16–33). Moreover, Petitioner asserts that "even if Ohsaki's translucent board 8 were somehow understood to be rectangular, obviousness does not require 'bodily incorporation' of features from one reference into another"; rather, a person of ordinary skill in the art "would have been fully capable of modifying Aizawa to feature a light permeable protruding convex cover to obtain the benefits" taught by Ohsaki. *Id.* at 17 (citing, e.g., Ex. 1047 ¶ 26). Similarly, regarding the location of the sensor, Petitioner asserts,

> [E]ven assuming for the sake of argument that a [person of ordinary skill in the art] would have understood Aizawa's sensor as being limited to placement on the backside of the wrist, and would have understood Ohsaki's sensor's "tendency to slip" when arranged on the front side as informing consideration of Ohsaki's teachings with respect to Aizawa, that ***would have further motivated*** the [person of ordinary skill in the art] to implement a light permeable convex cover in Aizawa's sensor, to improve detection efficiency of that sensor when placed on the palm side.

Id. at 19 (citing, e.g., Ex. 1047 ¶ 30). In other words, Ohsaki's disclosure that a convex surface suppresses variation in reflected light would have

motivated an artisan to add such a surface to Aizawa to improve detection efficiency of that sensor when placed on the palm side. *Id.* at 20–21.

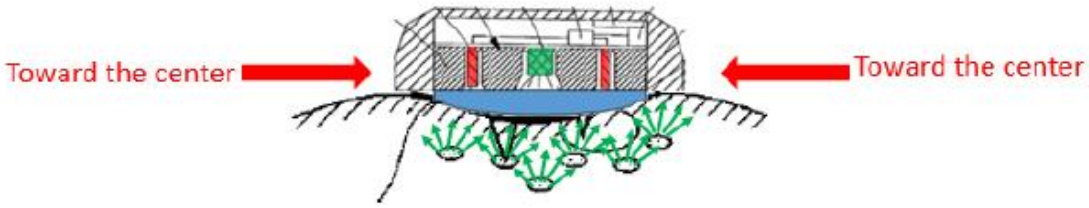
Concerning Patent Owner's third argument, Petitioner responds that adding a convex cover to Aizawa's sensor would not decrease signal strength but, instead, "would improve Aizawa's signal-to-noise ratio by causing more light backscattered from tissue to strike Aizawa's photodetectors than would have with a flat cover" because such a cover improves light concentration across the entire lens and does not direct it only towards the center. *Id.* at 21–28 (citing, e.g., Ex. 1047 ¶¶ 34–58).

Petitioner asserts that Patent Owner and Dr. Madisetti "ignore[] the well-known ***principle of reversibility***," by which "a ray going from P to S will trace the same route as one from S to P." Pet. Reply 23 (quoting Ex. 1051, 92; citing, e.g., Ex. 1051, 87–92; Ex. 1049, 106–111; Ex. 1047 ¶ 38). When applied to Aizawa's sensor, Petitioner contends that any condensing benefit achieved by a convex cover would thus direct emitted light toward Aizawa's peripheral detectors. *Id.* at 24–26 (citing, e.g., Ex. 1047 ¶¶ 40–49). Although Dr. Madisetti "refused to acknowledge" "this basic principle of reversibility during deposition," Petitioner contends it is applied in Aizawa. *Id.* at 25 (citing, e.g., Ex. 1052, 89:12–19; Ex. 1003 ¶ 127 (citing Ex. 1006 ¶ 33); Ex. 1047 ¶ 34).

Petitioner also asserts that Patent Owner and Dr. Madisetti overlook the fact that light rays reflected by body tissue will be scattered and diffuse and will approach the detectors "from various random directions and angles." Pet. Reply 26–28 (citing, e.g., Ex. 1019, 52, 86, 90; Ex. 1053, 803; Ex. 1047 ¶¶ 50–56; Ex. 2006, 163:12–164:2). This scattered and diffuse light, according to Petitioner, means that Ohsaki's convex cover cannot

"focus all light at the center of the sensor device," as Patent Owner argues. *Id.* at 27. Instead, due to the random nature of this scattered light, Petitioner asserts that a person of ordinary skill in the art would have understood that "Ohsaki's convex cover provides a slight refracting effect, such that light rays that otherwise would have missed the detection area are instead directed toward that area as they pass through the interface provided by the cover." *Id.* at 28 (citing, e.g., Ex. 1047 ¶¶ 55–56). Petitioner applies this understanding to Aizawa, and asserts that using a cover with a convex protrusion in Aizawa would "enable backscattered light to be detected within a circular active detection area surrounding" a central light source. *Id.* at 28 (citing, e.g., Ex. 1047 ¶ 56).

Petitioner relies upon the following illustration of this alleged effect. Pet. Reply 30–31 (citing Ex. 1047 ¶¶ 62–67).



The above illustration depicts backscattered light reflecting off user tissue in various directions, such that it impinges upon the peripheral detectors from various random angles and directions. *Id.* According to Petitioner, "light rays that otherwise would have missed the active detection area are instead directed toward that area as they pass through the interface provided by the convex cover." *Id.* at 31.

Finally, Petitioner dismisses Patent Owner's reliance on Figure 14B of the '765 patent because it "is not an accurate representation of light that has been reflected from a tissue measurement site. For example, the light

rays (1420) shown in FIG. 14B are collimated (i.e., travelling paths parallel to one another), and each light ray's path is perpendicular to the detecting surface." Pet. Reply 28–29 (citing, e.g., Ex. 1047 ¶¶ 57–60).

Concerning Patent Owner's fourth argument, Petitioner responds that even if a flat surface might be less prone to scratching, that possible disadvantage would have been weighed against the "known advantages of applying Ohsaki's teachings," and would not negate a motivation to combine. *Id.* at 33 (citing, e.g., Ex. 1047 ¶ 68). Moreover, Petitioner argues that "by choosing a suitable material of the protrusion to be scratch-resistant, it would have been obvious for a [person of ordinary skill in the art] to achieve both benefits of light gathering and scratch-resistance." *Id.*

Patent Owner's Sur-reply

Concerning Patent Owner's first and second arguments, Patent Owner reiterates its position that Ohsaki's purported benefits attach only to a sensor with a rectangular convex surface that is located on the back of the wrist, and that "even small changes in its sensor's orientation or body location result in 'a tendency to slip.'" PO Sur-reply 3–14, 6.

Concerning Patent Owner's third argument, Patent Owner asserts that Petitioner's Reply improperly presents several new theories as compared with the Petition. *Id.* at 16 (regarding reversibility), 19 (regarding refraction).

Patent Owner argues that Dr. Kenny and Petitioner have not overcome their admissions that a convex lens directs light toward the center. *Id.* at 15. Moreover, Patent Owner argues that Petitioner's discussion of the principle of reversibility is "irrelevant" because "Petitioner never explains how the principle of reversibility could apply to such 'random' scattered and

absorbed light" as is present when light interacts with user tissue. *Id.* at 16–17. The random nature of backscattered light, in Patent Owner's view, "hardly supports Petitioner's argument that light will necessarily travel the same paths regardless of whether the LEDs and detectors are reversed," and is irrelevant to the central issue presented here of "whether changing Aizawa's flat surface to a convex surface results in more light on Aizawa's peripherally located detectors." *Id.* at 17–18.

Patent Owner also asserts that Petitioner mischaracterizes Patent Owner's position, which is not that a cover with a convex protrusion "focuses ***all*** light to a single point" at the center of the sensor as Petitioner characterizes it. PO Sur-reply 19. Patent Owner's position, rather, is that Petitioner has not shown that a person of ordinary skill in the art "would have been motivated to change Aizawa's flat surface to a convex surface to improve signal strength." *Id.* In Patent Owner's view, by arguing that the convex cover provides only a "slight refracting effect," Petitioner undermines its contention that providing such a cover would have improved detection efficiency. *Id.* at 19–20.

Moreover, Patent Owner argues that Petitioner's theory regarding the "slight refracting effect" of a convex protrusion is "unavailing because it fails to consider the greater ***decrease*** in light at the detectors due to light redirection to a ***more*** central location." *Id.* at 20. According to Patent Owner, any light redirected from the sensor's edge could not make up for the loss of signal strength from light redirected away from the detectors and toward the center. *Id.*

Concerning Patent Owner's fourth argument, Patent Owner argues that Petitioner does not dispute Patent Owner's position that a flat cover

would be less prone to scratches and offers "***no*** plausible advantages for its asserted combination." *Id.* at 23. Moreover, Patent Owner argues that "the risk of scratches undermines Petitioner's argument that a [person of ordinary skill in the art] would have been motivated to add a convex cover to 'protect the elements within the sensor housing.'" *Id.*

Analysis

As noted above, Petitioner provides three rationales to support its contention that a person of ordinary skill in the art would have provided "a light permeable cover with a protruding convex surface," such as that taught by Ohsaki, to Aizawa's sensor: (1) to improve adhesion between the sensor and the user's tissue, (2) to improve detection efficiency, and (3) to protect the elements within the sensor housing. Pet. 33. We conclude all three rationales are supported by the evidence, as follows.

Rationales 1 and 2

The evidence of record persuades us that adding a convex cover, such as that taught by Ohsaki, would have improved adhesion between the sensor and the user's skin, which would have increased the signal strength of the sensor. Ohsaki teaches as much:

> [T]he convex surface of the translucent board 8 is in intimate contact with the surface of the user's skin. Thereby *it is prevented that the detecting element 2 slips off* the detecting position of the user's wrist 4. If the translucent board 8 has a flat surface, the detected pulse wave is adversely affected by the movement of the user's wrist 4 as shown in Fig. 4B. However, in the case that the translucent board 8 has a convex surface like the present embodiment, the *variation of the amount of the reflected light which is emitted from the light emitting element 6 and reaches the light receiving element 7 by being reflected by the surface of the user's skin is suppressed*. *It is also prevented*

> *that noise such as disturbance light from the outside penetrates the translucent board 8.* Therefore the pulse wave can be detected without being affected by the movement of the user's wrist 4 as shown in FIG. 4A.

Ex. 1009 ¶ 25 (emphases added); *see also id.* ¶ 27 ("stably fixed").

We credit Dr. Kenny's testimony that a person of ordinary skill in the art would have been motivated by such teachings to apply a cover with a convex surface to Aizawa to improve that similar device in the same way and to yield predictable results, i.e., to resist movement of the sensor on the user's wrist. *See, e.g.*, Ex. 1003 ¶¶ 99 ("[T]his contact between the convex surface and the user's skin is said to prevent slippage, which increases the strength of the signals obtainable by Ohsaki's sensor."), 101–102. We also credit Dr. Kenny's testimony that, in light of these teachings, a person of ordinary skill in the art would have made such a modification to improve the pulse sensor's ability to emit light into, and detect light reflected from, the user's wrist, to generate an improved pulse signal. Ex. 1003 ¶¶ 71, 98, 100; Ex. 1047 ¶¶ 7, 14.

Indeed, Ohsaki expressly compares the performance of a wrist-worn pulse wave sensor depending on whether translucent board 8 is convex or flat, and concludes the convex surface results in improved performance over the flat surface, especially when the user is moving. Ex. 1009, Figs. 4A–4B, ¶¶ 15, 25 (stating that with "a flat surface, the detected pulse wave is adversely affected by the movement of the user's wrist 4," and with "a convex surface like the present embodiment, the variation of the amount of the reflected light" collected by the sensor "is suppressed"). Ohsaki also states that, with a convex surface, "[i]t is also prevented that noise such as

disturbance light from the outside penetrates the translucent board 8." *Id.* ¶ 25.

We also credit Dr. Kenny's testimony that the proposed modification would have been within the skill level of an ordinary artisan. For example, Dr. Kenny testifies:

> [A person of ordinary skill in the art] would have combined the teachings of Aizawa-Inokawa and Ohsaki as doing so would have amounted to nothing more than the use of a known technique to improve similar devices in the same way. [One of ordinary skill] would have recognized that incorporating Ohsaki's convex surface is simply improving Aizawa-Inokawa's transparent plate 6 that has a flat surface to improve adhesion to a subject's skin and reduce variation in the signals detected by the sensor. Furthermore, the elements of the combined system would each perform similar functions they had been known to perform prior to the combination—Aizawa-Inokawa's transparent plate 6 would remain in the same position, performing the same function, but with a convex surface as taught by Ohsaki.

Ex. 1003 ¶ 102. In light of Ohsaki's express disclosure of the benefits of a convex cover, we credit Dr. Kenny's testimony that a person of ordinary skill in the art would have been motivated to modify Aizawa as proposed, and would have had a reasonable expectation of success in doing so.

We next address Patent Owner's first through third arguments, each of which implicates Petitioner's first and second asserted rationales of improved adhesion and detection efficiency.

Patent Owner's first argument is premised on the notion that Ohsaki's benefits only can be realized with a rectangular convex surface, because such a shape is required to avoid interacting with bones on the back of the user's forearm. PO Resp. 20–28. We disagree. Ohsaki does not disclose

the shape of its convex cover, much less require it be rectangular. In fact, Ohsaki is silent as to the shape of the convex surface. Ohsaki discloses that sensor 1 includes detecting element 2, which includes package 5 within which the sensor components are located. Ex. 1009 ¶ 17. Ohsaki's convex surface is located on board 8, which is "attached to the opening of the package 5." *Id.* Ohsaki provides no further discussion regarding the shape of board 8 or its convex protrusion.

We disagree with Patent Owner's suggestion that the shape of the convex surface can be inferred to be rectangular from Ohsaki's Figures 1 and 2. PO Resp. 15–17. Ohsaki does not indicate that these figures are drawn to scale, or reflect precise dimensions or shapes of the convex surface. *See, e.g.*, Ex. 1009 ¶ 13 ("schematic diagram"); Pet. Reply 16–17; *Hockerson-Halberstadt, Inc. v. Avia Group Int'l*, 222 F.3d 951, 956 (Fed. Cir. 2000) ("[I]t is well established that patent drawings do not define the precise proportions of the elements and may not be relied on to show particular sizes if the specification is completely silent on the issue.").

To be clear, Ohsaki describes the shape of *detecting element 2* as rectangular: "[T]he length of the detecting element from the right side to the left side in FIG. 2 is longer than the length from the upper side to the lower side." Ex. 1009 ¶ 19. Ohsaki also describes that detecting element 2 is aligned longitudinally with the user's forearm: "[I]t is desirable that the detecting element 2 is arranged so that its longitudinal direction agrees with the longitudinal direction of the user's arm," to avoid slipping off. *Id.*; *see also id.* ¶ 9 ("The light emitting element and the light receiving element are arranged in the longitudinal direction of the user's arm.").

In light of this disclosed rectangular shape of detecting element 2, it is certainly possible that Ohsaki's convex surface may be similarly shaped. But, it may not be. Contrary to Patent Owner's argument, Ohsaki neither describes nor requires detecting element 2 to have the same shape as the convex surface of board 8. *Accord* Pet. Reply. 14 (noting also that Ohsaki's board 8 "is not coextensive with the entire tissue-facing side of detecting element 2"). We have considered the testimony of both Dr. Kenny and Dr. Madisetti on this point. Ex. 1047 ¶¶ 10, 13, 19–26; Ex. 2004 ¶¶ 37–41 (relying on Ohsaki's Figures 1–2 to support the opinion that the convex surface is rectangular). Dr. Madisetti's reliance on the dimensions of Ohsaki's figures is unpersuasive. *Hockerson-Halberstadt*, 222 F.3d at 956. We credit Dr. Kenny's testimony that Ohsaki does not describe its convex surface as rectangular, because this testimony is most consistent with Ohsaki's disclosure.

Further, Patent Owner suggests that the convex surface *must be* rectangular, in order to avoid interacting with bones in the user's forearm. PO Resp. 21–23; PO Sur-reply 10 ("[A person of ordinary skill in the art] would have understood Ohsaki's convex board must ***also*** have a longitudinal shape oriented up-and-down the watch-side of the user's wrist/forearm."). Although Ohsaki recognizes that interaction with these bones can cause problems, (*see* Ex. 1009 ¶¶ 6, 19), we do not agree that the *only way* to avoid these bones is by aligning a rectangular cover with the longitudinal direction of the user's forearm. For example, in the annotated Figures provided by Patent Owner, *see* PO Resp. 24, we discern that the circular sensor that purports to depict the proposed modification would *also* avoid the bones in the forearm if it were slightly smaller. Patent Owner provides no persuasive

explanation to justify the dimensions it provides in this annotated figure, or to demonstrate that such a large sensor would have been required. Indeed, we discern that it would have been within the level of skill of an ordinary artisan to appropriately size a modified sensor to avoid these well-known anatomical obstacles. "A person of ordinary skill is also a person of ordinary creativity, not an automaton." *KSR*, 550 U.S. at 421. After all, an artisan must be presumed to know something about the art apart from what the references disclose. *See In re Jacoby*, 309 F.2d at 516.

Finally, we do not agree with Patent Owner's position that Ohsaki's advantages apply only to rectangular convex surfaces. As discussed, Patent Owner has not shown that Ohsaki's convex surface is rectangular at all. Moreover, even if Ohsaki's convex surface is rectangular, when discussing the benefits associated with a convex cover, Ohsaki does not limit those benefits to a cover of any particular shape. Instead, Ohsaki explains that "detecting element 2 is arranged on the user's wrist 4 so that the convex surface of the translucent board 8 is in intimate contact with the surface of the user's skin. Thereby it is prevented that the detecting element 2 slips off the detecting position of the user's wrist 4." Ex. 1009 ¶ 25; Ex. 1047 ¶¶ 12–13. Thus, we agree with Petitioner that Ohsaki's teaching of a convex surface would have motivated a person of ordinary skill in the art to add such a surface to Aizawa's circular-shaped sensor, to improve adhesion as taught by Ohsaki. Nothing in Ohsaki's disclosure limits such a benefit to a specific shape of the convex surface. Ex. 1047 ¶¶ 10, 12–14, 19–26.

Moreover, Ohsaki contrasts the ability to properly receive reflected light with a convex surface as compared to a flat surface and notes that,

> in the case that the translucent board 8 has a convex surface . . . the variation of the amount of the reflected light which is emitted from the light emitting element 6 and reaches the light receiving element 7 by being reflected by the surface of the user's skin is suppressed. It is also prevented that noise such as disturbance light from the outside penetrates the translucent board 8. Therefore the pulse wave can be detected without being affected by the movement of the user's wrist 4 as shown in FIG. 4A.

Ex. 1009 ¶ 25; Ex. 1047 ¶ 13. Again, we agree with Petitioner that Ohsaki's teaching of a convex surface would have motivated a person of ordinary skill in the art to add such a surface to Aizawa's sensor, to improve signal strength, as taught by Ohsaki. Again, nothing in Ohsaki's disclosure limits such a benefit to the shape of the convex surface. Ex. 1047 ¶¶ 13, 19–26. Accordingly, we do not agree that Ohsaki's disclosed advantages attach only to a rectangular convex surface, or would have been inapplicable to the proposed combination of Aizawa and Ohsaki.[5]

We have considered Patent Owner's second argument, that Ohsaki's benefits are realized only when the sensor and convex surface are placed on the back of the user's wrist, which is the opposite side of the wrist taught by Aizawa. PO Resp. 28–41. We do not agree. As an initial matter, Petitioner does not propose bodily incorporating the references; Petitioner simply proposes adding a convex cover to Aizawa's sensor, without discussing where Aizawa's sensor is used. *See, e.g.*, Pet. 31. In other words,

[5] Patent Owner also argues that, to the extent contended by Petitioner, it would not have been obvious to place a rectangular cover on top of Aizawa's sensor. PO Resp. 26–28. We do not understand Petitioner to have made any such contention and, accordingly, do not address this argument. *See, e.g.*, Pet. 31–35.

Petitioner's proposed modification does not dictate any particular placement, whether on the palm side or back side of the wrist.

To be sure, Ohsaki's Figures 3A–3B compare the performance of detecting element 2, including its translucent board 8 having a convex protrusion, and show better performance when the element is attached to the back side of the wrist versus the front side of the wrist, when the user is in motion. *See* Ex. 1009 ¶¶ 23–24, Figs. 3A–3B. However, we do not agree that these figures support Dr. Madisetti's conclusion that "Ohsaki indicates a convex surface only prevents slipping on the back (i.e., watch) side of the wrist in a specific orientation, but tends to slip when used in different locations or orientations" such as the palm side of the wrist—particularly in comparison to a flat surface such as Aizawa's. Ex. 2004 ¶¶ 66, 75. Instead, Ohsaki acknowledges that, even when the detecting element is located "on the front [palm] side of the user's wrist 4, *the pulse wave can be detected well* if the user is at rest." Ex. 1009 ¶ 23 (emphasis added). Thus, Ohsaki discloses that, in at least some circumstances, a convex surface located on the front of the user's wrist achieves benefits. *Id.* Notably, the claims are not limited to detection during movement or exercise.

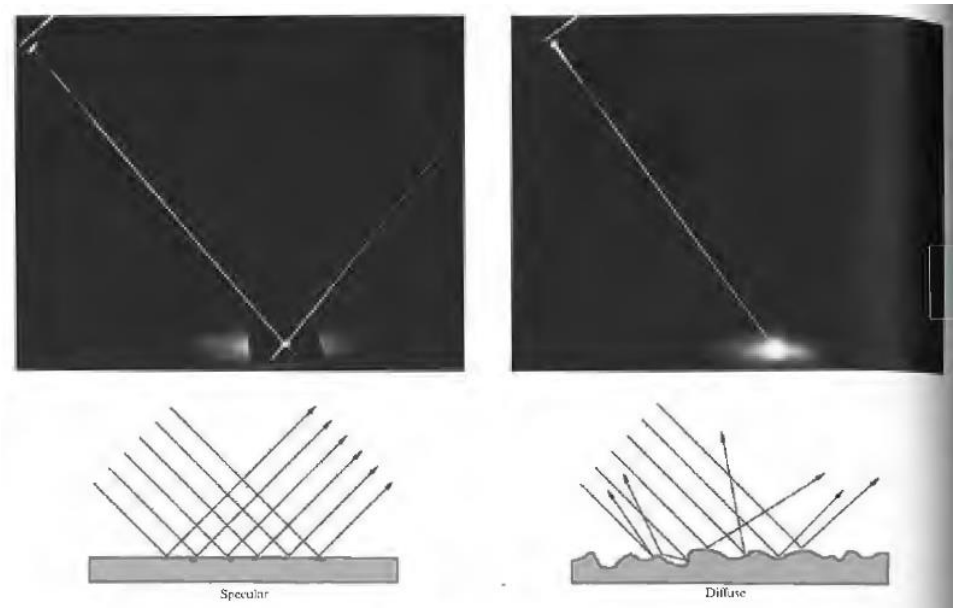
We credit, instead, Dr. Kenny's testimony that a person of ordinary skill in the art would have understood from Ohsaki that a convex protrusion will help prevent slippage, even in the context of Aizawa's sensor. *See* Ex. 1047 ¶¶ 11, 14, 16, 27–33. This is because the convex protrusion is in "intimate contact with the surface of the user's skin," *id.* ¶ 12, which "would have provided improved adhesion as described by Ohsaki in a sensor placed, e.g., on the palm side of the wrist, or other locations on the body." *Id.* ¶¶ 16, 28.

Dr. Madisetti testifies that "[b]ased on Aizawa's teaching that a flat acrylic plate improves adhesion on the palm side of the wrist, and Ohsaki's teaching that a convex surface tends to slip on the palm side of the wrist, a [person of ordinary skill in the art] would have come to the opposite conclusion from Dr. Kenny: that modifying Aizawa's flat adhesive plate 'to include a lens/protrusion . . . similar to Ohsaki's translucent board' would not 'improve adhesion.'" Ex. 2004 ¶¶ 84, 82. We disagree with this reading of Aizawa. It is true that Aizawa's plate 6 is illustrated as having a flat surface (Ex. 1006, Fig. 1(b)), and that Aizawa states the plate "improve[s] adhesion" (*id.* ¶ 13). Aizawa further states: "the above belt 7 is fastened such that the acrylic transparent plate 6 becomes close to the artery 11 of the wrist 10," and "[t]hereby, adhesion between the wrist 10 and the pulse rate detector 1 is improved." *Id.* ¶ 26. These disclosures, however, indicate the improved adhesion is provided by the acrylic material of plate 6, not the shape of the surface of the plate, which is never specifically addressed. *Id.* ¶¶ 30, 34 ("Since the acrylic transparent plate 6 is provided . . . adhesion between the pulse rate detector 1 and the wrist 10 can be improved . . . ."). Aizawa does not associate this benefit of improved adhesion with the surface shape of the plate, but rather, with the existence of an acrylic plate to begin with. Thus, there is no teaching away from using a convex surface to improve the adhesion of Aizawa's detector to the user's wrist.

We have considered Patent Owner's third argument that a convex cover would condense light away from Aizawa's peripheral detectors, which Patent Owner alleges would decrease signal strength. PO Resp. 41–48. We disagree.

There appears to be no dispute that when emitted light passes through user tissue, the light diffuses and scatters as it travels. *See, e.g.*, Pet. Reply 26 ("[R]eflectance-type sensors detect light that has been 'partially reflected, transmitted, absorbed, and scattered by the skin and other tissues and the blood before it reaches the detector.' Thus, a [person of ordinary skill in the art] would have understood that light reaches the active detection area from various random directions and angles.") (quoting Ex. 1019, 86); PO Sur-reply 16 ("Even Petitioner admits, however, that tissue randomly scatters and absorbs light rays."), Tr. 33:13–34:7 (Patent Owner's counsel stating that "when [light] goes into the tissue you get the diffusion and that is random scattering, correct").

The light thus travels at random angles and directions, and no longer travels in a collimated and perpendicular manner. Exhibit 1050,[6] Figure 4.12, illustrates the difference between diffuse and collimated light, and is reproduced below:



[6] Eugene Hecht, *Optics* (2nd ed. 1990).

This figure provides at left a photograph and an illustration showing incoming collimated light reflecting from a smooth surface, and at right a photograph and an illustration of incoming collimated light reflecting from a rough surface. *See* Ex. 1050, 87–88 (original page numbers). The smooth surface provides specular reflection, in which the reflected light rays are collimated like the incoming light rays. *See id.* The rough surface provides diffuse reflection, in which the reflected light rays travel in random directions. *See id.*; *see also* Ex. 1047 ¶¶ 42–43 (discussing Ex. 1050, Figure 4.12), 50 ("A [person of ordinary skill in the art] would have understood that light that backscatters from the measurement site (after diffusing through tissue) reaches the active detection area from many random directions and angles.").

Dr. Kenny testifies that Aizawa's sensor "detect[s] light that has been 'partially reflected, transmitted, absorbed, and scattered by the skin and other tissues and the blood before it reaches the detector.'" Ex. 1047 ¶ 50 (quoting Ex. 1019, 86). Dr. Kenny further opines that a convex cover, when added to Aizawa's sensor with multiple detectors symmetrically arranged about a central light source, "allows light rays that otherwise would have missed the detection area to instead be directed toward that area as they pass through the interface provided by the cover," thus increasing the light-gathering ability of Aizawa's sensor. *Id.* ¶¶ 56, 62.

By contrast Dr. Madisetti testifies that "a convex 'lens/protrusion' would direct light away from the detectors and thus result in decreased light collection and optical signal strength at the peripheral detectors" because it condenses light towards the center of the sensor and away from the peripheral detectors. Ex. 2004 ¶¶ 85–86, 89. We have considered this

testimony, however, Dr. Madisetti's opinions largely are premised upon the behavior of collimated and perpendicular light as depicted in Figure 14B of the challenged patent. *See id.* ¶ 88. Dr. Madisetti does not explain how light would behave when approaching the sensor from various angles, as it would after being reflected by tissue. *Id.* ¶¶ 86–89; *see also id.* ¶¶ 90–97 (addressing motivation and also failing to discuss diffuse, scattered light). In other words, even if Patent Owner is correct that the '765 patent's Figure 14B depicts light condensing toward the center, this is not dispositive to the proposed modification, because light reflected by a user's tissue is scattered and random, and is not collimated and perpendicular as shown in Figure 14B. Ex. 1001, Fig. 14B.

Patent Owner and Dr. Madisetti argue that "Petitioner and Dr. Kenny both [previously admitted] that a convex cover condenses light towards the center of the sensor and away from the periphery," in a different petition filed against a related patent, i.e., in IPR2020-01520. PO Resp. 42–44; Ex. 2004 ¶ 86. The cited portions of the Petition and Dr. Kenny's declaration from IPR2020-01520 discuss a decrease in the "mean path length" of a ray of light when it travels through a convex lens rather than through a flat surface. *See, e.g.*, Ex. 2020 ¶¶ 118–120. We do not agree that this discussion is inconsistent with Dr. Kenny's testimony here that, where light is reflected to the detectors at various random angles and directions, more light will reach Aizawa's symmetrically disposed detectors when travelling through the convex surface than would be reached without such a surface, because light that might have otherwise missed the detectors now will be captured. *See, e.g.*, Ex. 1047 ¶¶ 34, 37, 56; *see generally id.* ¶¶ 34–67. We do not discern that the convergence of a single ray of light toward

the center, as discussed in IPR2020-01520, speaks to the aggregate effect on *all* light that travels through the convex surface.

We additionally do not agree with Patent Owner's argument that Petitioner's Reply presents new theories that should have been first presented in the Petition, to afford Patent Owner an adequate opportunity to respond. The Petition proposed a specific modification of Aizawa to include a convex protrusion in the cover, for the purpose of, *inter alia*, increasing the light gathering ability of Aizawa's device. *See* Pet. 31–35. Patent Owner's Response then challenged that contention, with several arguments that Petitioner's proposed convex protrusion would not operate in the way the Petition alleges it would operate. *See* PO Resp. 41–48. This opened the door for Petitioner to provide, in the Reply, arguments and evidence attempting to rebut the contentions in the Patent Owner Response. *See* PTAB Consolidated Trial Practice Guide (Nov. 2019) ("Consolidated Guide"),[7] 73 ("A party also may submit rebuttal evidence in support of its reply."). This is what Petitioner did here. The Reply does not change Petitioner's theory for obviousness; rather, the Reply presents more argument and evidence in support of the same theory for obviousness presented in the Petition. *Compare* Pet. 31–35, *with* Reply 21–32.

Rationale 3

Petitioner further contends that a person of ordinary skill in the art would have recognized that a cover with a protruding convex surface, such as that taught by Ohsaki, would "protect the elements within the sensor housing" of Aizawa. Pet. 33. We are persuaded that adding a convex cover,

[7] Available at https://www.uspto.gov/TrialPracticeGuideConsolidated.

such as that taught by Ohsaki, would also protect the sensor's internal components in a manner similar to Aizawa's flat acrylic plate. Ex. 1003 ¶ 101; *see also* Ex. 1008 ¶ 15 (noting that a cover "protect[s] the LED or PD").

We disagree with Patent Owner's fourth argument that a person of ordinary skill in the art would not have modified Aizawa as proposed because a convex cover would be prone to scratches and because other alternatives existed. Patent Owner does not explain how the potential presence of scratches on a convex cover would preclude that cover's ability to, nonetheless, protect the internal sensor components in Aizawa, as Petitioner proposes. That a convex cover may be more prone to scratches than Aizawa's flat cover is one of numerous tradeoffs that a person of ordinary skill in the art would consider in determining whether the benefits of increased adhesion, signal strength, and protection outweigh the potential for a scratched cover. *Medichem, S.A. v. Rolabo, S.L.*, 437 F.3d 1157, 1165 (Fed. Cir. 2006). Moreover, as Petitioner notes, and Patent Owner does not dispute, a scratch resistant material could be employed in fabricating the cover. Pet. Reply 33; PO Sur-reply 23. The record does not support the premise that the possibility of scratches alone would have dissuaded a person of ordinary skill in the art from the proposed modification, to achieve the benefits identified by Petitioner.

For the foregoing reasons, we are persuaded by Petitioner's contentions.

vii. "[f] a handheld computing device in wireless communication with the physiological sensor device, wherein the handheld computing device comprises"

Petitioner's Contentions

Petitioner contends that the combination of, *inter alia*, Aizawa and Inokawa teaches a sensor device that is in wireless communication with a base device through its LEDs, wherein that base device is connected further to a PC. Pet. 24, 54; *see, e.g.*, Ex. 1006 ¶ 15 ("a transmitter for transmitting the measured pulse rate data to a display for displaying the pulse rate data"); Ex. 1008 ¶¶ 75 (sensed physiological information is transmitted from the sensor to the base device and, further, "[t]he base device 17 . . . transmits this information to the PC 59"), 76, 77.

Petitioner also contends that Mendelson-2006 discloses a body-worn pulse oximetry system including a sensor module, a receiver module, and a PDA. Pet. 26; *see, e.g.*, Ex. 1010, 1–2 (describing system), Fig. 1 (sensor attached to skin), Fig. 3 (PDA). Petitioner contends that signals are wirelessly transmitted to the PDA through a receiver module. Pet. 26–28; Ex. 1010, 2. Petitioner contends that wireless transmission to a PDA, as discussed in Mendelson-2006, provides advantages such as offering "a low-cost touch screen interface," and "more effective medical care." Pet. 27–28; Ex. 1010, 3–4.

Petitioner contends that a person of ordinary skill in the art "would have also found it obvious to implement the physiological sensor device resulting from the combined teachings of Aizawa, Inokawa, and Ohsaki as part of a physiological measurement system including a handheld computing device, and to enable the physiological sensor device to communicate

wirelessly with the handheld computing device," to obtain the advantages taught by Mendelson-2006. Pet. 25, 25–30, 41 n.5; Ex. 1003 ¶¶ 88–97, 125–128.

Patent Owner's Arguments

Patent Owner disputes Petitioner's contentions. Patent Owner argues that Petitioner's proposed combination is rooted in hindsight and results in a more complicated system. PO Resp. 58, 59. Specifically, Patent Owner characterizes Petitioner's combination as

> (1) eliminat[ing] Aizawa's existing transmitter so the resulting device will not require "a separate RF circuit"; (2) chang[ing] Aizawa's structure to add a second LED to transmit data using a base station, which would also require that a user remove the sensor before any data transfer can occur and thus eliminate the ability to display data in real-time; and then (3) add[ing] back in a separate communications circuit to the base station based on Mendelson 2006 so that the base station can send data to a PDA with a touch screen display.

Id. at 58–60 (citing, e.g., Ex. 2004 ¶ 114). Patent Owner further argues that such a modification eliminates the desired real-time monitoring employed by Mendelson-2006. *Id.* 58–59 (citing Ex. 2004 ¶¶ 113, 115).[8]

Analysis

As discussed above in Section II.D.5.iii, we determine that Petitioner demonstrated sufficiently that a person of ordinary skill in the art would have found it obvious to modify Aizawa to include an additional LED to, *inter alia*, allow for wireless transmission of sensed pulse rate and motion

[8] We do not address Patent Owner's argument that Mendelson-2006 does not disclose a "multi-emitter/multi-detector sensor" because Mendelson-2006 is not relied upon for such limitations. *See supra* § II.D.iii, iv.

data to a base device. We further noted that although Aizawa discloses transmission of data for display (Ex. 1006 ¶¶ 15, 35), Aizawa is silent as to how the data is transmitted or displayed. In light of the combination with Inokawa, therefore, Aizawa's multiple LEDs would have allowed wireless transmission of data to a base device. *See, e.g.*, Ex. 1008 ¶ 76 ("[V]ital sign information stored in the memory 63, such as pulse and body motion, is transmitted to the base device 17 using the S-side infrared LED 23 of the pulse sensor 1 and the B-side PD 45 of the base device 17.").

Inokawa further discloses that the base device, once it receives information from the sensor, "transmits this information to the PC 59." *Id.* ¶¶ 75, 67, 77. As described by Dr. Kenny, "the physiological sensor device's sensor component transmits physiological measurement data to an included base station via an optical communications interface, and the physiological sensor device's base station transmits signals responsive to a physiological parameter to a computer, via a network interface." Ex. 1003 ¶ 81.

With this backdrop, we are persuaded by Petitioner's contention that it would have been obvious to implement the physiological sensor device resulting from the combined teachings of Aizawa, Inokawa, and Ohsaki as part of a physiological measurement system that includes a handheld computing device. Indeed, Aizawa and Inokawa already teach the desirability of transmitting sensed data to, e.g., a computer or a display, although neither discloses further detail. *See, e.g.*, Ex. 1006, 15; Ex. 1008 ¶ 75; *see also* Ex. 1047 ¶ 56 (Aizawa is silent). In light of these teachings, we credit Dr. Kenny's testimony that transmitting sensed data wirelessly to a handheld computing device, as taught by Mendelson-2006, would have

achieved the identified benefits of, e.g., providing a low-cost display with a simple user interface and easy activation of functions and the ability to provide more effective medical care (Ex. 1003 ¶¶ 93–95). *See, e.g.*, *id.* ¶¶ 88–97, 125–128; Ex. 1047 ¶ 79. We are also persuaded that this would have been within the skill level of an ordinary artisan and would have achieved predictable results. Ex. 1003 ¶ 96.

We do not agree with Patent Owner's characterization of the proposed combination. Petitioner does not propose "(1) eliminat[ing] Aizawa's existing transmitter . . . (2) chang[ing] Aizawa's structure to add a second LED to transmit data using a base station . . .; and then (3) add[ing] back in a separate communications circuit to the base station." *Contra* PO Resp. 58–59; Ex. 1047 ¶ 77. As discussed above, Petitioner proposes that the system suggested by, *inter alia*, Aizawa and Inokawa—which includes a sensor in communication with a base device, and which contemplates additional communication from the base device to a PC—further includes a handheld computing device in wireless communication with that system. In other words, Petitioner's proposed combination effectively replaces or supplements Inokawa's PC 59 with a PDA, such as that taught by Mendelson-2006. Thus, in Petitioner's proposed combination, physiological data is sensed by Aizawa's sensor, transmitted to a base device through an additional LED, as taught by Inokawa, and further transmitted to, *inter alia*, a PDA, as taught by Mendelson-2006. *See, e.g.*, Pet. 24–30; *see also id.* at 41 n.5 (describing the proposed combination as, *inter alia*, adding "Inokawa's base station to Aizawa's physiological sensor device such that the sensor device includes a sensor and a base station with which the sensor communicates and through which the sensor communicates with a handheld

device"). Indeed, both Aizawa and Inokawa expressly contemplate transmission to an additional computing device (*see, e.g.*, Ex. 1006, 15; Ex. 1008 ¶ 75); Petitioner's proposed modification merely states that such transmission occurs wirelessly to a handheld device. The record supports this contention.

We have considered Dr. Madisetti's testimony, but it is based on the same mischaracterization put forth by Patent Owner. Ex. 2004 ¶¶ 112 (mischaracterizing the combination), 114 (same). Notwithstanding this misrepresentation of the proposed modification, Dr. Madisetti does not dispute Dr. Kenny's testimony that wireless transmission to a handheld computing device would have achieved the identified benefits, such as a low-cost device that improves medical care. *See id.* ¶¶ 112–118. As such, we credit Dr. Kenny's unrebutted testimony.

Patent Owner and Dr. Madisetti further criticize the combination, asserting that Mendelson-2006's wireless transmission exists to allow real-time monitoring, which is impossible where a sensor must be mounted on a base device to transfer information through LEDs. *Id.* ¶ 113; PO Resp. 59. However, as discussed in Section II.D.iii above, the lack of real-time measurement and transmission is simply one consideration among many. As noted in Inokawa, real-time wireless communication has its drawbacks. Ex. 1008 ¶ 5. We discern that a skilled artisan would have weighed these competing interests. "[A] given course of action often has simultaneous advantages and disadvantages, and this does not necessarily obviate motivation to combine." *Medichem*, 437 F.3d at 1165 (citation omitted).

viii. "[g] one or more processors configured to wirelessly receive one or more signals from the physiological sensor device, the one or more signals responsive to at least a physiological parameter of the user"

The cited evidence supports Petitioner's contention that Mendelson-2006 describes wirelessly transmitting vital physiological information acquired from a sensor to a PDA, which receives it. Pet. 57–58; *see, e.g.*, Ex. 1010, 1, 2 ("The PDA can monitor multiple wearable pulse oximeters simultaneously and allows medics to collect vital physiological information to enhance their ability to extend more effective care to those with the most urgent needs."), 3 (explaining that the PDA "has sufficient computational resources for the intended application" and "can also serve to temporarily store vital medical information received from the wearable unit"), 3 ("The [PDA's graphical user interface] also displays the subject's vital signs, activity level, body orientation, and a scrollable PPG waveform that is transmitted by the wearable device."), Fig. 3 (displaying SpO_2 and HR data); Ex. 1003 ¶¶ 129–132.

As discussed above, Petitioner's proposed combination involves transmission of sensed data from Aizawa's physiological sensor to a base device, as taught by Inokawa, and further wireless transmission of that data from the base station to a handheld computing device, such as a PDA. *See supra* §§ II.D.5.iii (transmission to base station accomplished with an additional LED, as taught by Inokawa), II.D.5.vii (further transmission from base device to, e.g., a PC and/or PDA, as taught by Mendelson-2006, and contemplated by Aizawa and Inokawa). In light of these teachings, we are persuaded by Petitioner's contention that a person of ordinary skill in the art "would have found it obvious to configure a processor of the PDA to wirelessly receive signals from the physiological sensor device" taught by

the combination of, *inter alia*, Aizawa, Inokawa, and Mendelson-2006, wherein "the signals [are] responsive to physiological parameters of the user." Pet. 57–58; *see, e.g.*, Ex. 1003 ¶ 132.

Petitioner's stated reasoning for the proposed modification is sufficiently supported, including by the unrebutted testimony of Dr. Kenny. Ex. 1003 ¶¶ 129–132. Patent Owner does not present any argument against this limitation, apart from the arguments already addressed in Section II.D.5.vii.

ix. "[h]–[j] a touch-screen display configured to provide a user interface, wherein: the user interface is configured to display indicia responsive to measurements of the physiological parameter, and an orientation of the user interface is configurable responsive to a user input"

The cited evidence supports Petitioner's contention that Mendelson-2006 describes a PDA with a touchscreen display configured to display indicia responsive to measurements of, e.g., SpO_2 and HR. Pet. 58–61; *see, e.g.*, Ex. 1010, 3 ("The use of a PDA . . . also provides a low-cost touch screen interface.").

Petitioner acknowledges that "Mendelson-2006 does not explicitly state that an orientation of the GUI provided by the PDA is configurable responsive to a user input." Pet. 60. However, Petitioner contends that a person of ordinary skill in the art would have understood that "the LabVIEW software that was used 'to control all interactions between the PDA and the wearable unit via [t]he graphical user interface' included the option to configure an orientation of a user interface," e.g., by setting the report orientation to portrait or landscape view. *Id.* at 60–61 (alteration in

original); *see, e.g.*, Ex. 1003 ¶¶ 133–138; Ex. 1027, 186 ("Set the report orientation—portrait or landscape.").

Petitioner further contends that, in light of these teachings, a person of ordinary skill in the art "would have found it obvious to make an orientation of the PDA's user interface configurable responsive to a user input, for the sake of user convenience." Pet. 61; *see, e.g.*, Ex. 1003 ¶ 138.

Petitioner's stated reasoning for the proposed modification is sufficiently supported, including by the unrebutted testimony of Dr. Kenny. *See, e.g.*, Ex. 1003 ¶¶ 133–138. Patent Owner does not present any argument against this limitation, apart from the arguments already addressed in Section II.D.5.vii.

x. "[k] a storage device configured to at least temporarily store at least the measurements of the physiological parameter"

The cited evidence supports Petitioner's contention that Mendelson-2006 teaches that the PDA is configured to store vital medical information received from the wearable pulse oximeter, and that an ordinarily skilled artisan "would have understood that the vital medical information would have included measurements of the physiological parameters obtained by the physiological sensor device (e.g., SpO_2 and HR)." Pet. 62; Ex. 1010, 3 ("The PDA can also serve to temporarily store vital medical information received from the wearable unit."); Ex. 1003 ¶ 140. Thus, Petitioner contends that a person of ordinary skill in the art "would have configured a storage device of the PDA to at least temporarily store measurements of physiological parameters (e.g., SpO_2 and HR)." Pet. 62; *see, e.g.*, Ex. 1003 ¶ 139.

Petitioner's stated reasoning for the proposed modification is sufficiently supported, including by the unrebutted testimony of Dr. Kenny. *See, e.g.*, Ex. 1003 ¶¶ 139–140. Patent Owner does not present any argument against this limitation, apart from the arguments already addressed in Section II.D.5.vii.

xi. Reasonable Expectation of Success

Patent Owner argues that Petitioner has failed to demonstrate a reasonable expectation of success because Dr. Kenny did not perform a design analysis to create a functional sensor. PO Resp. 61–62. We disagree. As discussed in detail above, each of Petitioner's proposed modifications to Aizawa—whether to include a second emitter, as taught by Inokawa; or to include a cover with a convex surface, as taught by Ohsaki; or to communicate with a handheld computing device, as taught by Mendelson-2006—is rooted in explicit teachings of the prior art, and is supported by persuasive declarant testimony.

We credit Dr. Kenny's testimony that, for each proposed modification, the combined prior art teachings would have been applied as known, to achieve predictable results. *See, e.g.*, Ex. 1003 ¶¶ 86 (applying Inokawa's teachings would have been "nothing more than the use of a known technique to improve similar devices in the same way and combining prior art elements according to known methods to yield predictable results," e.g., improving Aizawa's sensor "to detect and record body motion in addition to blood flow"), 102 (applying Ohsaki's teachings would have been "nothing more than the use of a known technique to improve similar devices in the same way," which would "improve adhesion to a subject's skin and

reduce variation in the signals detected by the sensor"), 96 ("[A]pplying Mendelson-2006's . . . would have led to predictable results without altering or hindering the functions performed by the sensor."). For similar reasons discussed above with respect to each proposed modification, we conclude that that a skilled artisan would have had a reasonable expectation of success. *See supra* § II.D.5.iii, vi, vii–x; Ex. 1003 ¶¶ 79–140.

xii.Summary

For the foregoing reasons, we determine that Petitioner has met its burden of demonstrating by a preponderance of the evidence that claim 1 would have been obvious over the cited combination of references.

6. Independent Claim 21

Independent claim 21 consists of limitations that are substantially similar to elements [a]–[f] of claim 1. *Compare* Ex. 1001, 44:51–45:15, *with id.* at 46:31–49 (reciting that the convex surface is "located between tissue of the user and all of the at least four detectors," instead of "above all of the at least four detectors" as in claim 1; omitting details of the "handheld computing device"). In asserting that claim 21 also would have been obvious over the combined teachings of Aizawa, Inokawa, Ohsaki, and Mendelson-2006, Petitioner refers to the same arguments presented as to claim 1. *See* Pet. 87–89; Ex. 1003 ¶¶ 173–179. Patent Owner relies on the same arguments discussed above regarding claim 1. PO Resp. 11–61.

For the same reasons discussed above, we determine that Petitioner has met its burden of demonstrating by a preponderance of the evidence that claim 21 would have been obvious over the cited combination of references. *See supra* § II.D.5.

7. Dependent Claims 12, 18, and 29

Dependent claim 12 ultimately depends from independent claim 1 and further recites "the protruding convex surface protrudes a height between 1 millimeter and 3 millimeters." Ex. 1001, 45:65–67.

Dependent claim 18 ultimately depends from independent claim 1 and further recites "the protruding convex surface protrudes a height greater than 2 millimeters and less than 3 millimeters." *Id.* at 46:23–23. Dependent claim 29 ultimately depends from independent claim 21 and includes the same further limitation as claim 18. *Id.* at 48:14–16.

Petitioner contends that the sensor rendered obvious by the combined teachings of Aizawa, Inokawa, Ohsaki, and Mendelson-2006 would have included a cover with a protruding convex surface. *See supra* § II.D.5.vi. With respect to claim 12, Petitioner contends that a person of ordinary skill in the art "would have found it obvious that a device designed to fit on a user's wrist would be on the order of millimeters," consistent with Ohsaki's disclosure that the device is in "intimate contact" with the user's skin. Pet. 78–79 (citing, e.g., Ex. 1003 ¶¶ 159–160). Petitioner also contends that an ordinarily skilled artisan would have taken user comfort into account when establishing the dimensions of the device's convex cover. *Id.* With these considerations in mind, Petitioner contends that, "in order to provide a comfortable cover featuring a protruding convex surface that prevents slippage, the surface should protrude a height between 1 millimeter and 3 millimeters," because "there would have been a finite range of possible protruding heights, and it would have been obvious to select a protruding height that would have been comfortable to the user." *Id.* (citing, e.g., Ex. 1003 ¶ 161). With respect to claims 18 and 29, Petitioner incorporates

its contentions regarding, *inter alia*, claim 12. Pet. 87, 93; Ex. 1003 ¶¶ 169, 191.

Patent Owner argues that none of the cited references disclose the claimed height range and that Petitioner relies on hindsight reconstruction. PO Resp. 63–64 (citing, e.g., Ex. 2004 ¶¶ 121–124). Patent Owner also characterizes Dr. Kenny's testimony as conclusory and unsupported. *Id.* at 65–66.

Petitioner is correct that, "[w]hen there are a finite number of identified, predictable solutions, a person of ordinary skill in the art has good reason to pursue the known options within his or her technical grasp. If this leads to the anticipated success, it is likely the product . . . of ordinary skill and common sense." *KSR*, 550 U.S. at 398. Petitioner has shown sufficiently that only a finite number of solutions existed with respect to the height of a convex protrusion on a tissue-facing sensor, which would have met the art-recognized goals of both (1) intimate contact between the sensor's surface and the user and (2) user comfort. *See, e.g.*, Ex. 1009 ¶¶ 6, 25. Bearing in mind these considerations, we credit Dr. Kenny's testimony that it would have been obvious, "in order to provide a comfortable cover featuring a protruding convex surface that prevents slippage, [that] the surface should protrude a height between 1 millimeter and 3 millimeters," as recited in claim 12, and which further includes the claimed range of 2 to 3 millimeters as recited in claims 18 and 29. Ex. 1003 ¶ 161. Further, the record does not support that any new and unexpected results were achieved at the claimed height greater than 2 millimeters and less than 3 millimeters.

We have considered Patent Owner's argument, and Dr. Madisetti's cited testimony. However, it is not dispositive that none of Mendelson-799,

Ohsaki, Schulz, or Mendelson-2006 teach the claimed range. PO Resp. 63; Ex. 2004 ¶¶ 122. Petitioner relies upon the knowledge, ability, and creativity of a person of ordinary skill in the art, not the teachings of a specific reference. Notably, Dr. Madisetti does not dispute Dr. Kenny's position that there were a finite number of options available for the height of the convex surface. Ex. 2004 ¶¶ 121–124. Therefore, we do not agree that Petitioner's contentions are rooted in impermissible hindsight. *See, e.g.*, *In re McLaughlin*, 443 F.2d 1392, 1395 (CCPA 1971) ("Any judgment on obviousness is in a sense necessarily a reconstruction based upon hindsight reasoning, but so long as it takes into account only knowledge which was within the level of ordinary skill at the time the claimed invention was made and does not include knowledge gleaned only from applicant's disclosure, such a reconstruction is proper.").

Accordingly, for the foregoing reasons, we determine that Petitioner has met its burden of demonstrating by a preponderance of the evidence that claims 12, 18, and 29 would have been obvious over the cited combination of references.

8. Dependent Claims 2–8, 10, 11, 13, 15–17, and 19–28

Petitioner also contends that claims 2–8, 10, 11, 13, 15–17, and 19–28 would have been obvious based on the same combination of prior art addressed above. These challenged claims all depend directly or indirectly from independent claim 1 or 21. Petitioner identifies teachings in the prior art references that teach or suggest the limitations of these claims, and provides persuasive reasoning as to why the claimed subject matter would have been obvious to one of ordinary skill in the art. Pet. 62–87, 89–93.

Petitioner also supports its contentions for these claims with the testimony of Dr. Kenny. Ex. 1003 ¶¶ 141–172, 180–191.

Patent Owner does not present any arguments for these claims other than those we have already considered with respect to independent claims 1 and 21. PO Resp. 62 ("T]he Petition fails to establish that independent claims 1 and 21 are obvious in view of the cited references of Ground 1 and therefore fails to establish obviousness of any of the challenged dependent claims."); *see supra* § II.D.5.

We have considered the evidence and arguments of record and determine that Petitioner has demonstrated by a preponderance of the evidence that claims 2–8, 10, 11, 13, 15–17, and 19–28 would have been obvious over the combined teachings of Aizawa, Inokawa, Ohsaki, and Mendelson-2006, for the reasons discussed in the Petition and as supported by the testimony of Dr. Kenny

9. Summary

For the foregoing reasons, we determine that Petitioner has met its burden of demonstrating by a preponderance of the evidence that claims 1–8, 10–13, and 15–29 would have been obvious over the cited combination of references.

E. Obviousness over the Combined Teachings of Aizawa, Inokawa, Ohsaki, Mendelson-2006, and Bergey

Petitioner contends that claim 9 would have been obvious over the combined teachings of Aizawa, Inokawa, Ohsaki, Mendelson-2006, and Bergey. Pet. 93–96.

1. Overview of Bergey (Ex. 1016)

Bergey is a U.S. patent titled "Solid State Watch with Magnetic Setting," and discloses a watch in which the electronics are "hermetically sealed in the watch case to be free of dust and moisture." Ex. 1016, code (57). Moreover, the electronic components are "resiliently mounted for improved shock resistance." *Id.*

Petitioner contends that it would have been obvious to have modified the sensor of Aizawa-Inokawa-Ohsaki-Mendelson-2006 to hermetically seal the sensor components within the substrate, wall, and cover, so as to obtain advantages disclosed by Bergey, e.g., to protect the electronics and prevent condensation within the case. Pet. 88–89 (citing Ex. 1003 ¶¶ 278–281; Ex. 1016, code (57), 2:56–67, 8:48–9:34).

2. Analysis

Petitioner also contends that claim 9 would have been obvious over the combined teachings of Aizawa, Inokawa, Ohsaki, Mendelson-2006, and Bergey. Pet. 93–96. Claim 9 depends indirectly from independent claim 1. Petitioner identifies teachings in the prior art references that teach or suggest the limitations of this claim, and provides persuasive reasoning as to why the claimed subject matter would have been obvious to one of ordinary skill in the art. *Id.* Petitioner also supports its contentions for this claim with the testimony of Dr. Kenny. Ex. 1003 ¶¶ 76–76, 192–196.

Patent Owner does not present any argument for this claim other than those we have already considered with respect to independent claim 1. PO Resp. 66 ("Bergey's alleged disclosure of a hermetically sealed watch does not fix the deficiencies identified for Ground 1."); *see supra* § II.D.

We have considered the evidence and arguments of record, including those directed to claim 1 and addressed above, and we determine that Petitioner has demonstrated by a preponderance of the evidence that claim 9 would have been obvious over the combined teachings of Aizawa, Inokawa, Ohsaki, Mendelson-2006, and Bergey for the reasons discussed in the Petition and as supported by the testimony of Dr. Kenny. *See, e.g.*, Ex. 1016, 8:48–9:34; Ex. 1003 ¶¶ 192–196.

F. Obviousness over the Combined Teachings of Aizawa, Inokawa, Ohsaki, Mendelson-2006, and Goldsmith

Petitioner contends that claim 14 would have been obvious over the combined teachings of Aizawa, Inokawa, Ohsaki, Mendelson-2006, and Goldsmith. Pet. 96–100.

1. Overview of Goldsmith (Ex. 1011)

Goldsmith is a U.S. patent application publication titled "Watch Controller for a Medical Device," and discloses a watch controller device that communicates with an infusion device to "provid[e] convenient monitoring and control of the infusion pump device." Ex. 1011, codes (54), (57).

Goldsmith's Figures 9A and 9B are reproduced below.

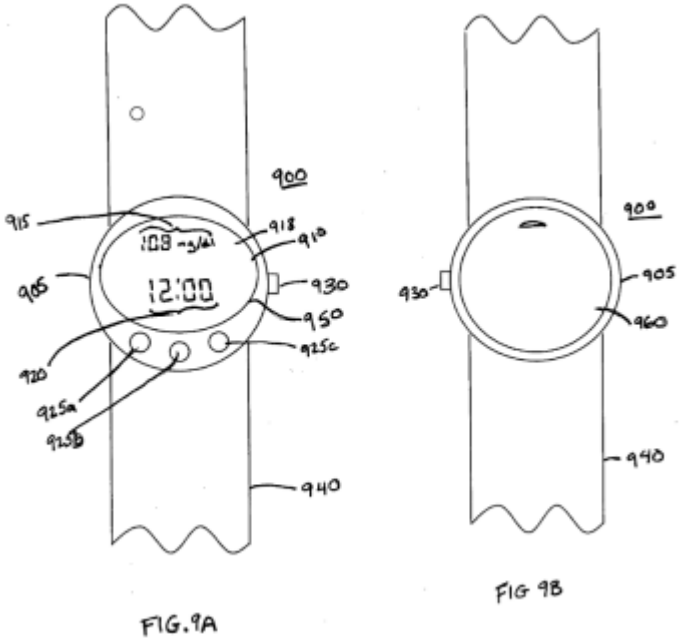


FIG.9A FIG 9B

Figure 9A and Figure 9B are respective front and rear views of a combined watch and controller device. *Id.* ¶¶ 30–31. As shown in Figure 9A, watch controller 900 includes housing 905, transparent member 950, display 910, input devices 925a–c, scroll wheel 930, and wrist band 940. *Id.* ¶¶ 85–86. Figure 9B shows rear-side cover 960, and a rear view of housing 905, scroll wheel 930, and wrist band 940. *Id.*

Goldsmith discloses the watch controller may interact with one or more devices, such as infusion pumps or analyte monitors. *Id.* ¶ 85; *see also id.* ¶ 88 ("The analyte sensing device 1060 may be adapted to receive data from a sensor, such as a transcutaneous sensor."). Display 910 "may display at least a portion of whatever information and/or graph is being displayed on the infusion device display or on the analyte monitor display," such as, e.g., levels of glucose. *Id.* ¶ 86. The display is customizable in a variety of configurations including user-customizable backgrounds, languages, sounds, font (including font size), and wall papers. *Id.* ¶¶ 102, 104. Additionally, the watch controller may communicate with a remote station, e.g., a

computer, to allow data downloading. *Id*. ¶ 89 (including wireless). The remote station may also include a cellular telephone to be "used as a conduit for remote monitoring and programming." *Id.*

2. Analysis

Petitioner also contends that claim 14 would have been obvious over the combined teachings of Aizawa, Inokawa, Ohsaki, Mendelson-2006, and Goldsmith. Pet. 96–100. Claim 14 depends indirectly from independent claim 1. Petitioner identifies teachings in the prior art references that teach or suggest the limitations of this claim, and provides persuasive reasoning as to why the claimed subject matter would have been obvious to one of ordinary skill in the art. *Id*. Petitioner also supports its contentions for this claim with the testimony of Dr. Kenny. Ex. 1003 ¶¶ 77–78, 197–202.

Patent Owner does not present any argument for this claim other than those we have already considered with respect to independent claim 1. PO Resp. 66–67 ("Goldsmith's alleged disclosure of a watch controller device with a display does not fix the deficiencies identified for Ground 1."); *see supra* § II.D.

We have considered the evidence and arguments of record, including those directed to claim 1 and addressed above, and we determine that Petitioner has demonstrated by a preponderance of the evidence that claim 14 would have been obvious over the combined teachings of Aizawa, Inokawa, Ohsaki, Mendelson-2006, and Goldsmith for the reasons discussed in the Petition and as supported by the testimony of Dr. Kenny. *See, e.g.*, Ex. 1011 ¶¶ 11, 87, 95, 102; Ex. 1003 ¶¶ 197–202.

III. CONCLUSION

In summary:[9]

Claims	35 U.S.C. §	Reference(s)/ Basis	Claims Shown Unpatentable	Claims Not Shown Unpatentable
1–8, 10–13, 15–29	103	Aizawa, Inokawa, Ohsaki, Mendelson-2006	1–8, 10–13, 15–29	
9	103	Aizawa, Inokawa, Ohsaki, Mendelson-2006, Bergey	9	
14	103	Aizawa, Inokawa, Ohsaki, Mendelson-2006, Goldsmith	14	
Overall Outcome			1–29	

[9] Should Patent Owner wish to pursue amendment of the challenged claims in a reissue or reexamination proceeding subsequent to the issuance of this decision, we draw Patent Owner's attention to the April 2019 *Notice Regarding Options for Amendments by Patent Owner Through Reissue or Reexamination During a Pending AIA Trial Proceeding*. *See* 84 Fed. Reg. 16654 (Apr. 22, 2019). If Patent Owner chooses to file a reissue application or a request for reexamination of the challenged patent, we remind Patent Owner of its continuing obligation to notify the Board of any such related matters in updated mandatory notices. *See* 37 C.F.R. § 42.8(a)(3), (b)(2).

IV. ORDER

Upon consideration of the record before us, it is:

ORDERED that claims 1–29 of the '765 patent have been shown to be unpatentable; and

FURTHER ORDERED that, because this is a final written decision, parties to the proceeding seeking judicial review of the decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

IPR2020-01715
Patent 10,631,765 B1

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CERTIFICATE OF SERVICE

I hereby certify that the original of this Notice of Appeal was filed via U.S.P.S. Priority Mail Express on April 12, 2022 with the Director of the United States Patent and Trademark Office at the address below:

Office of the Solicitor
United States Patent and Trademark Office
Mail Stop 8, Post Office Box 1450
Alexandria, Virginia 22313-1450

A copy of this Notice of Appeal is being filed and served on April 12, 2022 as follows:

To the USPTO Patent Trial and Appeal Board:
Patent Trial and Appeal Board
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Alexandria, VA 22313

(*via PTAB E2E – as authorized by the Board*)

To the U.S. Court of Appeals for the Federal Circuit:
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Dated: April 12, 2022

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